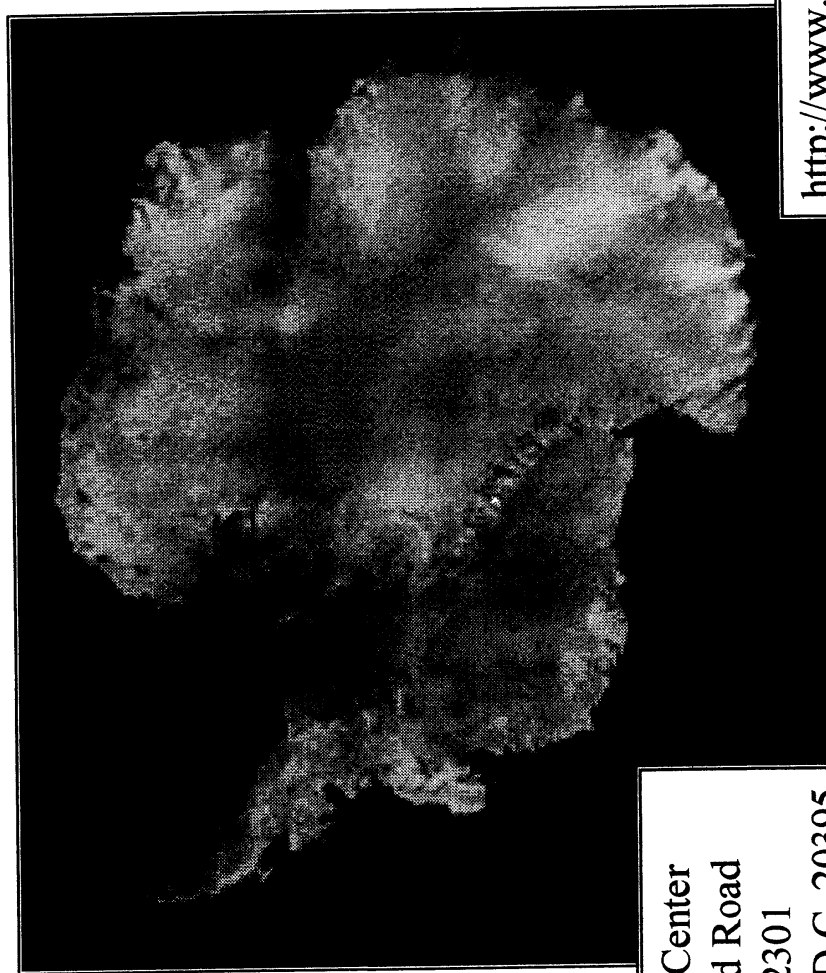




# National Ice Center Antarctic Sea Ice Atlas 1996



19990722 019



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Washington D.C. 20395

<http://www.natice.noaa.gov>

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## PREFACE

The National Ice Center (NIC), under sponsorship of the United States Navy, the United States Coast Guard, and the National Oceanic and Atmospheric Administration (NOAA), provides sea ice analyses encompassing the "Arctic" and the "Antarctic". These analyses continue the data set established under our previous name, the Joint Ice Center. These atlases continue the near real-time integration of remotely sensed data and point observations and differ only in that the Arctic and Antarctic are split into two separate publications per hemisphere per year.

This publication is the 11<sup>th</sup> edition of the annual "Antarctic Sea Ice Atlas" published in hard copy format by the NIC. The atlas contains weekly charts depicting the sea ice extent and coverage in the Southern Hemisphere from the first week of January through December 1996.

The NIC uses a wide variety of data sources in the production of sea ice analyses. Table 1 lists the data sources used to produce the Antarctic weekly ice analyses contained in this publication. The line types used in the analyses provide metadata information with regard to sensor type. Solid lines depict boundaries derived from: point observations, Defense Meteorological Satellite Program Operational Line Scan (DMSP OLS) and NOAA Advanced Very High-Resolution Radiometer (AVHRR) data. Dash-dash-dotted line depicts boundaries derived from DMSP Special Sensor Microwave Imager (SSM/I), and dashed lines depict boundaries derived from forecast models and climatology.

Please direct questions or comments to the NIC Liaison Branch, at phone number (301) 457-5303 extension 311 or 303, facsimile number (301) 457-5300, or electronic mail address: [laison@natice.noaa.gov](mailto:laison@natice.noaa.gov)

**Atlas addendum:** This publication is intended to serve as an interim solution, while transitioning to distribution via CD-ROM. The purpose of this atlas is to make all National Ice Center (NIC) sea ice charts available to customers using NIC designated archive centers. By fall 1999, it is anticipated that NIC will complete and distribute Arctic/Antarctic ice atlases on CD-ROM for 1995, 1996, 1997 and 1998. It should be noted that the charts presented in this atlas have been drawn by hand for operational use. Corrections to "hand annotations" are visible on some of the charts in the atlas.

From	To	Sensor Platform	Sensor and Type	Spectral Region	Resolution	Coverage
01-96	12-96	DMSP F-10, 11, 12, 13	OLS Fine: VIS IR SSM/I	0.4 to 1.1 $\mu$ m 10.2 to 12.8 $\mu$ m 19.35 and 37GHz	0.55 km  25 km	3,012km  3,012km
01-96	12-96	NOAA 12, 14	AVHRR: HRPT/LAC VIS NIR IR	0.58 to 0.68 $\mu$ m 0.72 to 1.10 $\mu$ m 3.55 to 3.93 $\mu$ m	1.1km at nadir; 2.5km at swath edge	4,000km

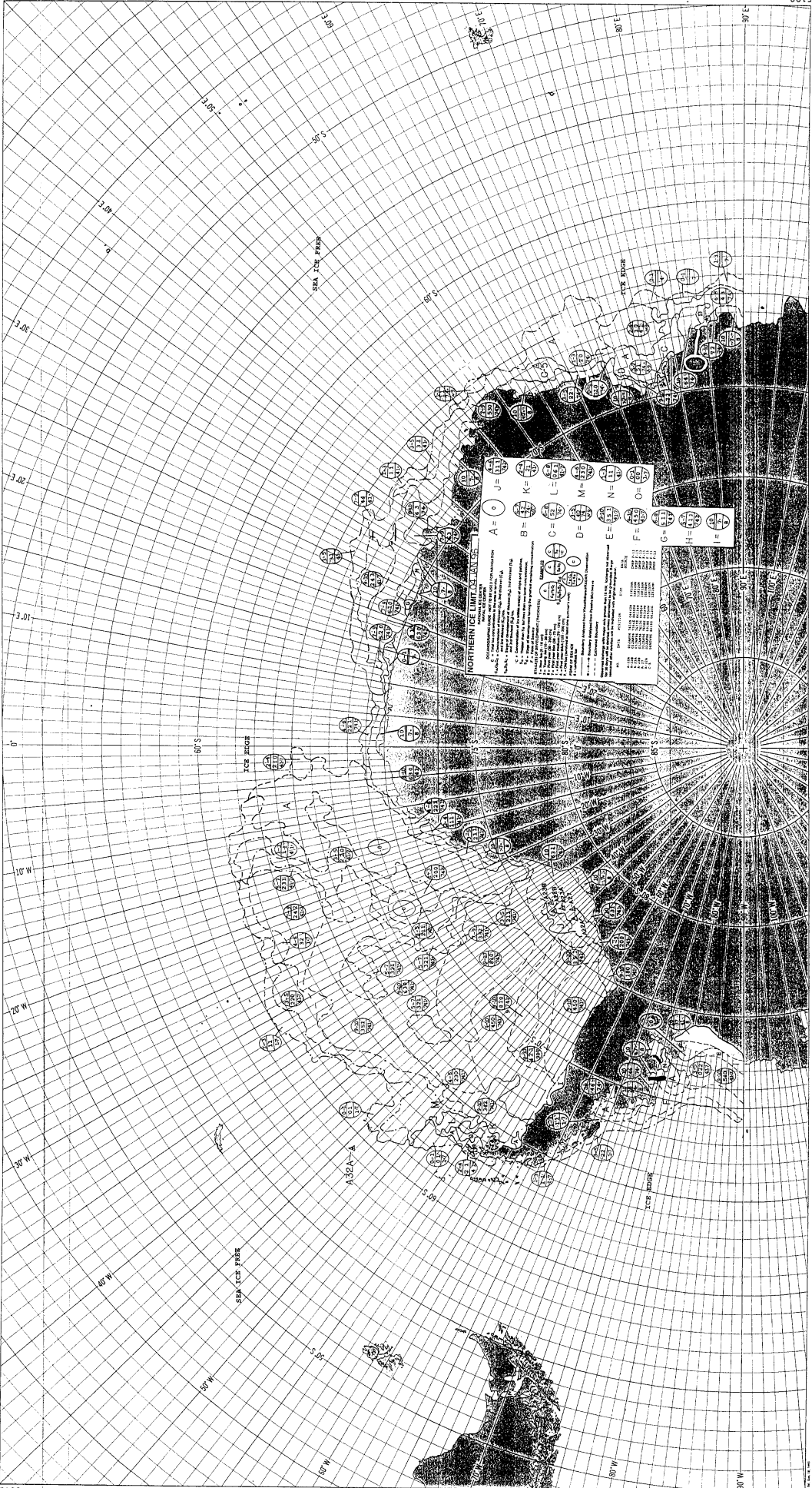
**TABLE 1. 1996 Antarctic Satellite Data Sources**

### Abbreviations and Acronyms:

AVHRR- Advanced Very High Resolution Radiometer  
cm- centimeter  
GHz- Gigahertz  
HRPT- High Resolution Picture transmission  
IR- Infrared  
km- kilometer  
LAC- Local Area Coverage  
NIR- Near Infrared  
OLS- Operational Linescan System  
SSM/I- Special Sensor Microwave Imager  
 $\mu$ m- micrometer  
VIS- Visible

Antarctica satellite composite courtesy of United States Geological Survey, Flagstaff, AZ.  
(<http://TerraWeb.wr.usgs.gov/TRS/projects/Antarctica/color/images>).

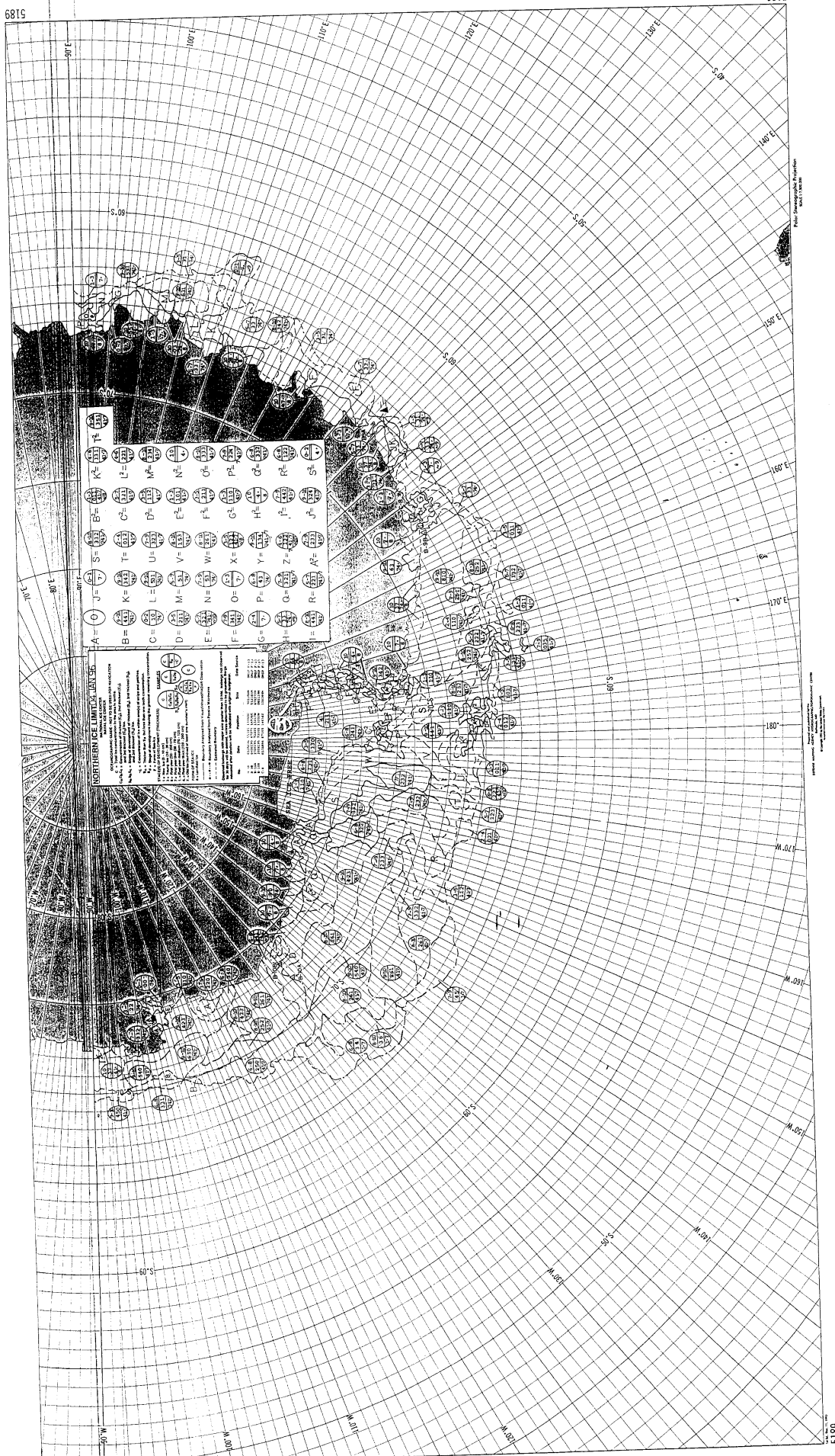
Prepared under the authority of Commander, Naval Oceanography Command, Stennis Space Center, MS 39529-5000



**NORTH ATLANTIC OCEAN**  
NORTH ATLANTIC OCEAN  
NORTH ATLANTIC OCEAN

Symbol	Meaning
A	Light
B	Light
C	Light
D	Light
E	Light
F	Light
G	Light
H	Light
I	Light
J	Light
K	Light
L	Light
M	Light
N	Light
O	Light

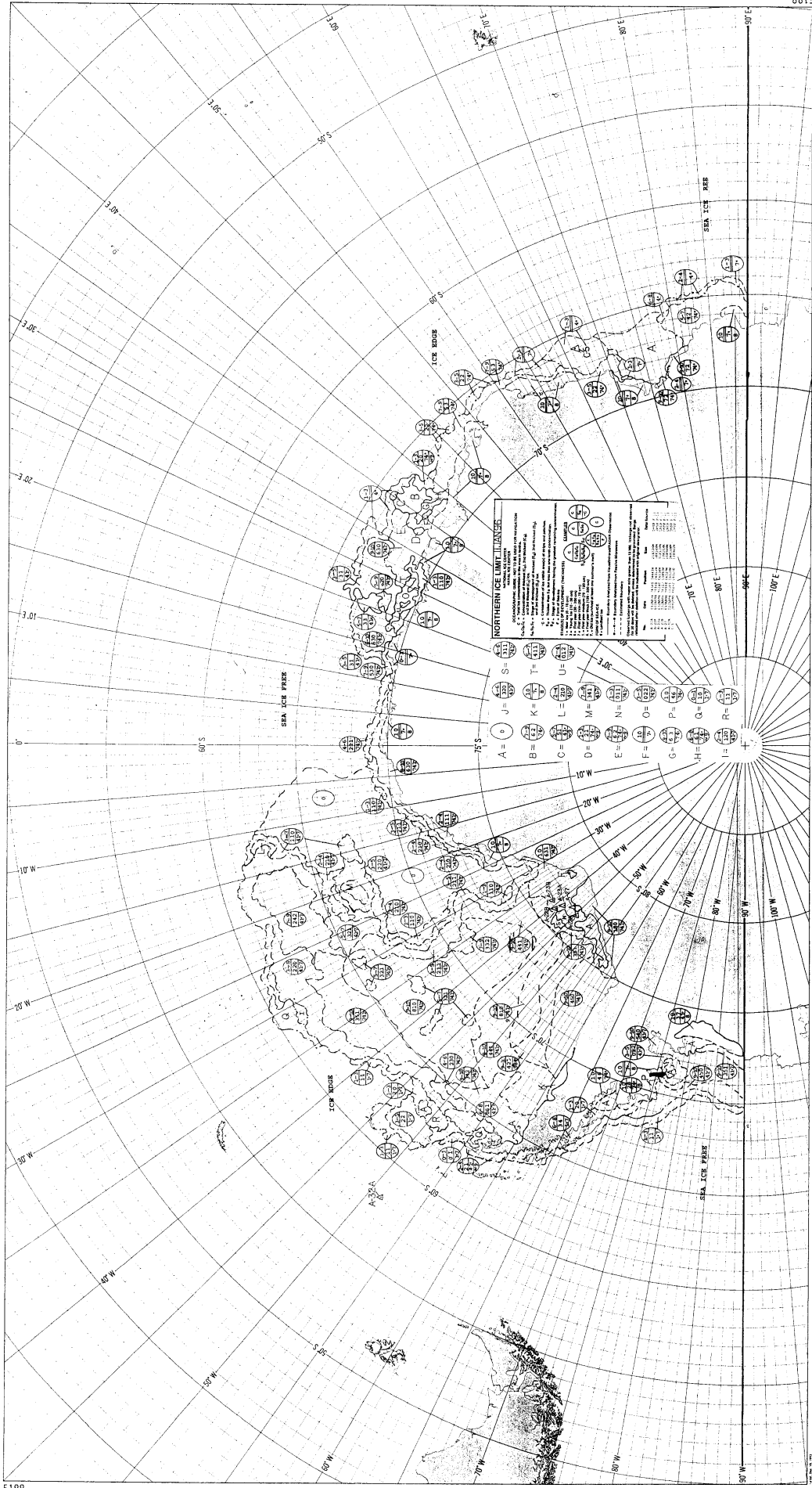
**Legend**  
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B = Light  
C = Light  
D = Light  
E = Light  
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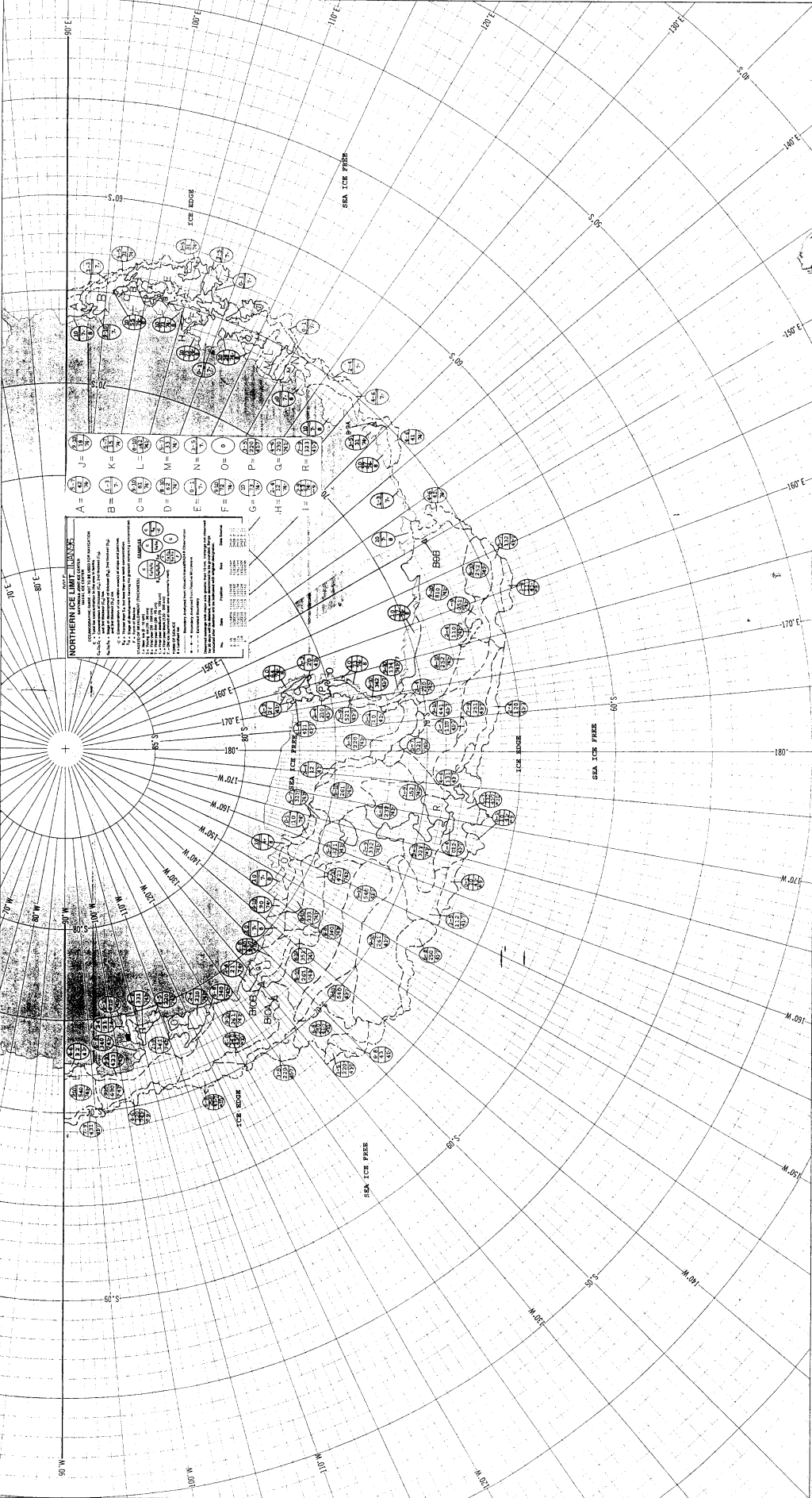


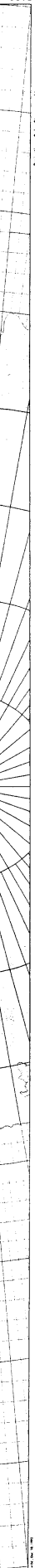
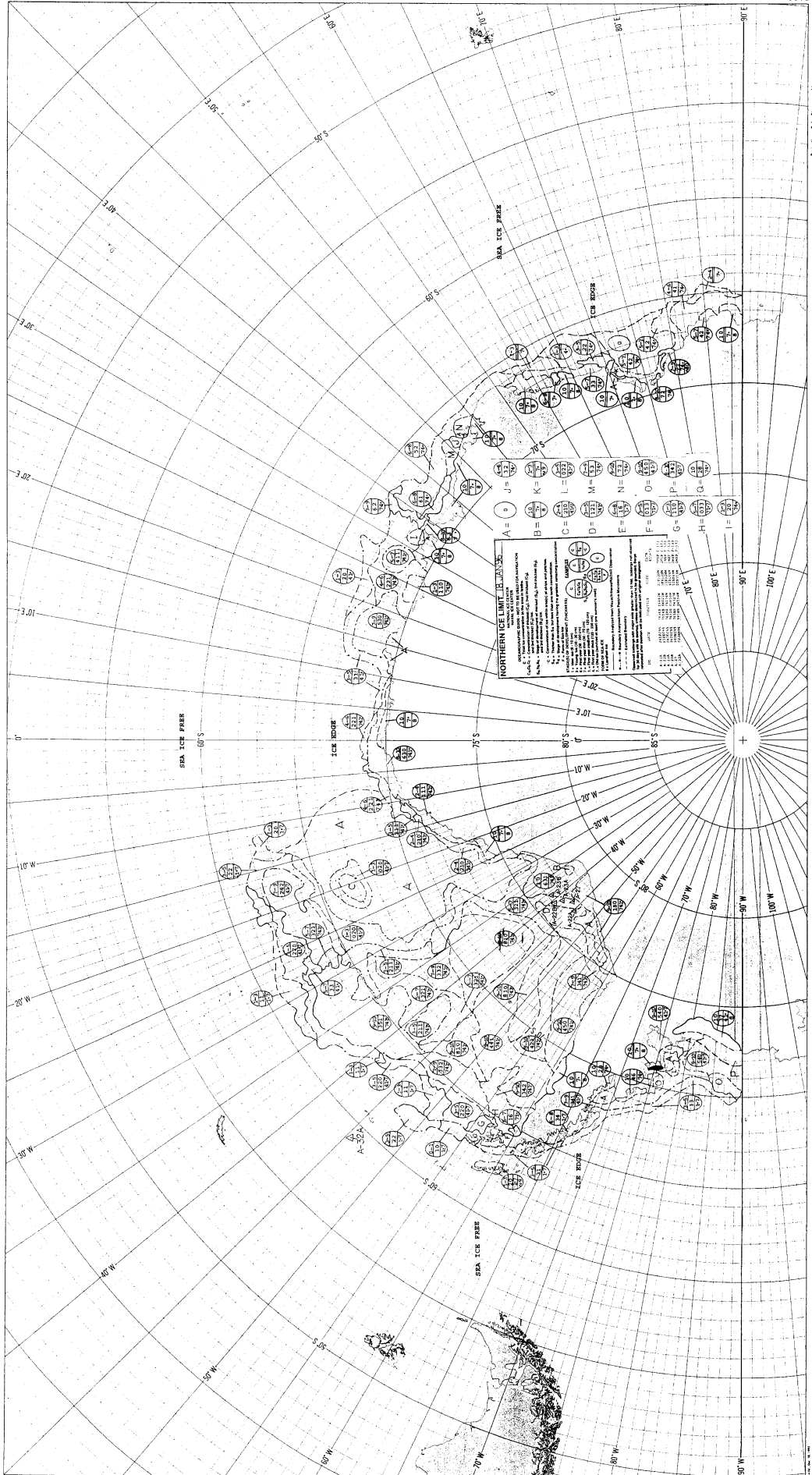
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**NORTHERN ICE LIMITS, JAN. 56.**  
This chart shows the northern limits of the ice in the North Atlantic Ocean, based on data collected during the first five months of 1956. The limits are shown for the months of January, February, March, April, and May. The chart is a map of the North Atlantic Ocean, showing the limits of the ice in the North Atlantic Ocean, based on data collected during the first five months of 1956. The limits are shown for the months of January, February, March, April, and May. The chart is a map of the North Atlantic Ocean, showing the limits of the ice in the North Atlantic Ocean, based on data collected during the first five months of 1956. The limits are shown for the months of January, February, March, April, and May.

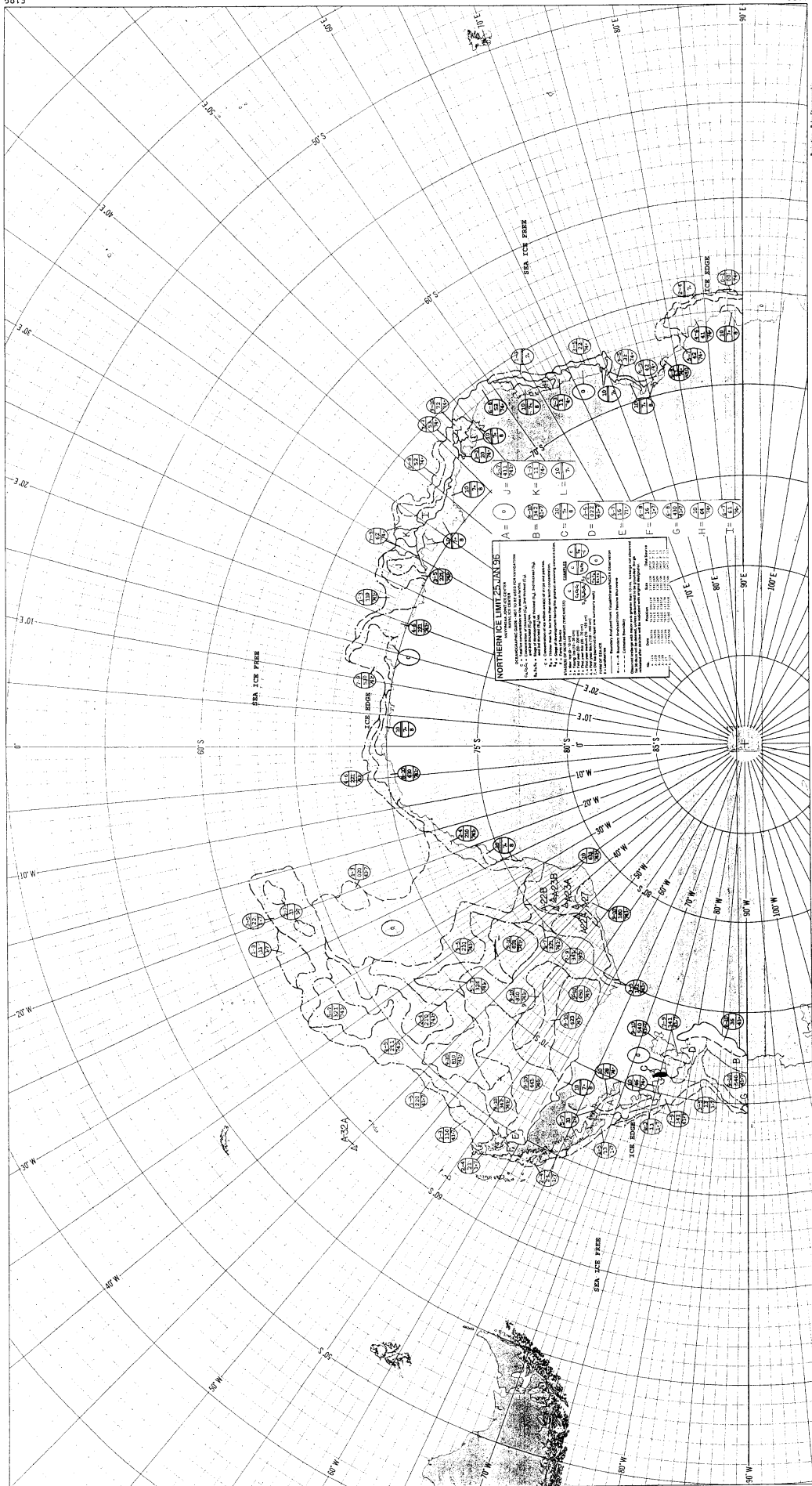






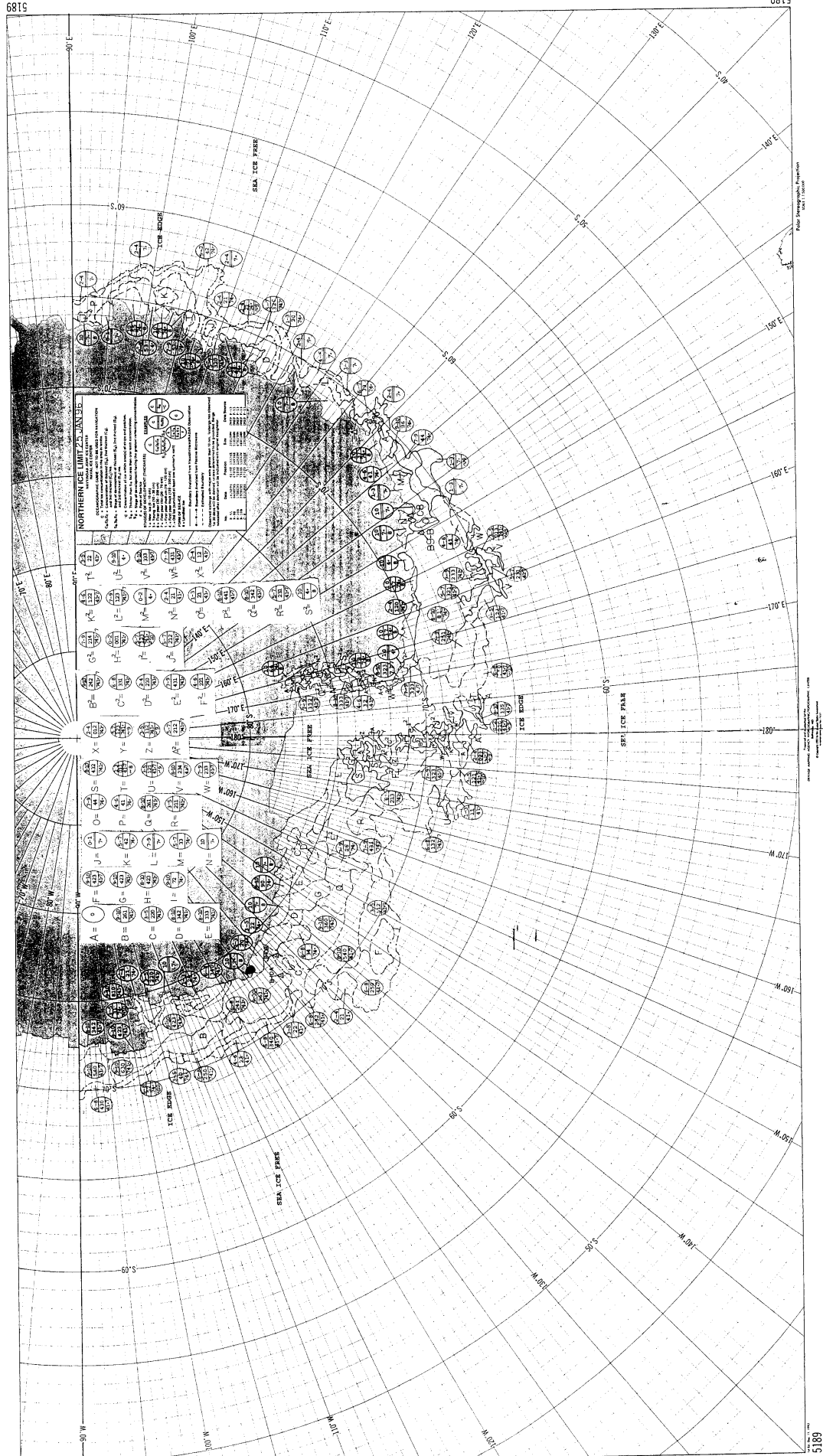




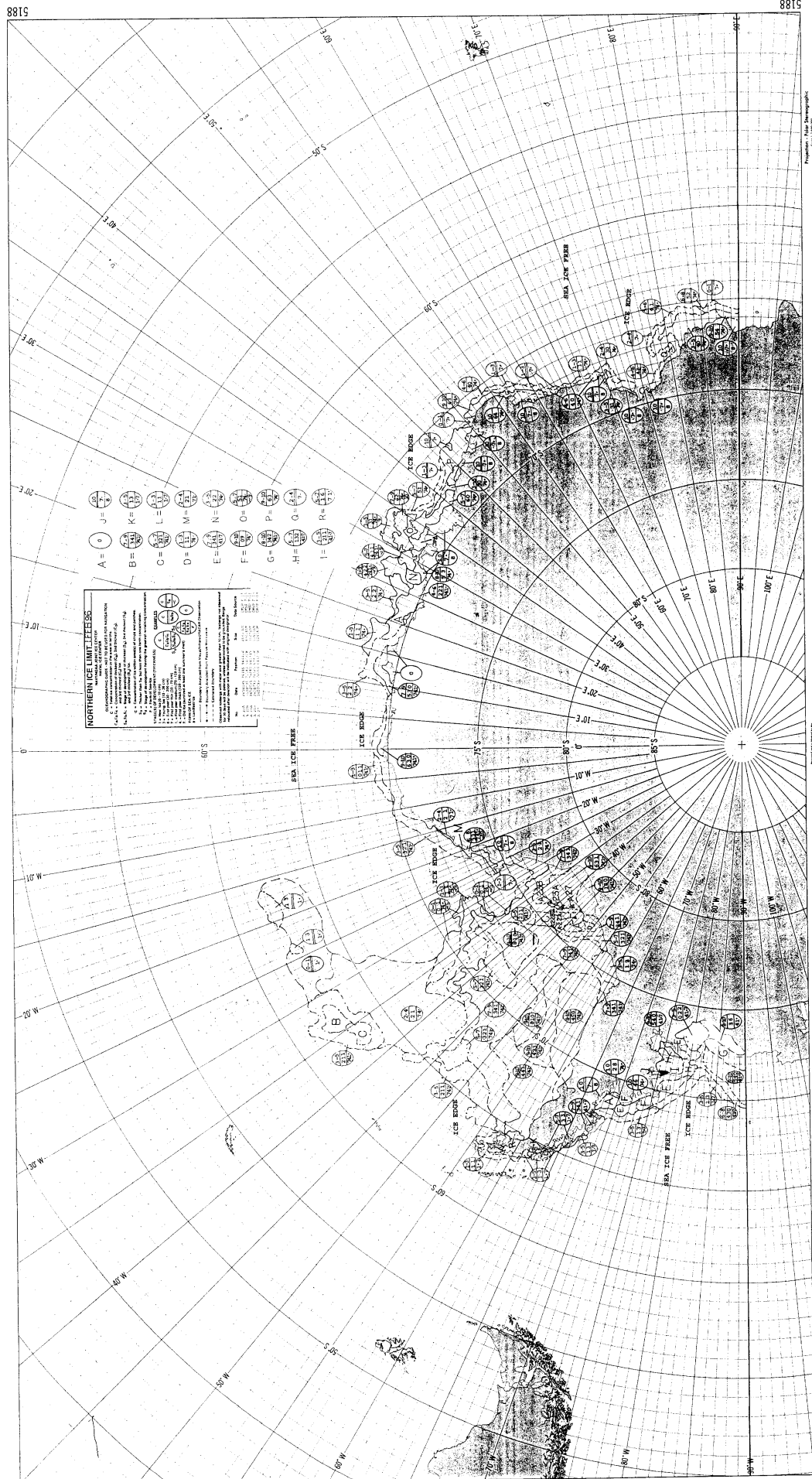


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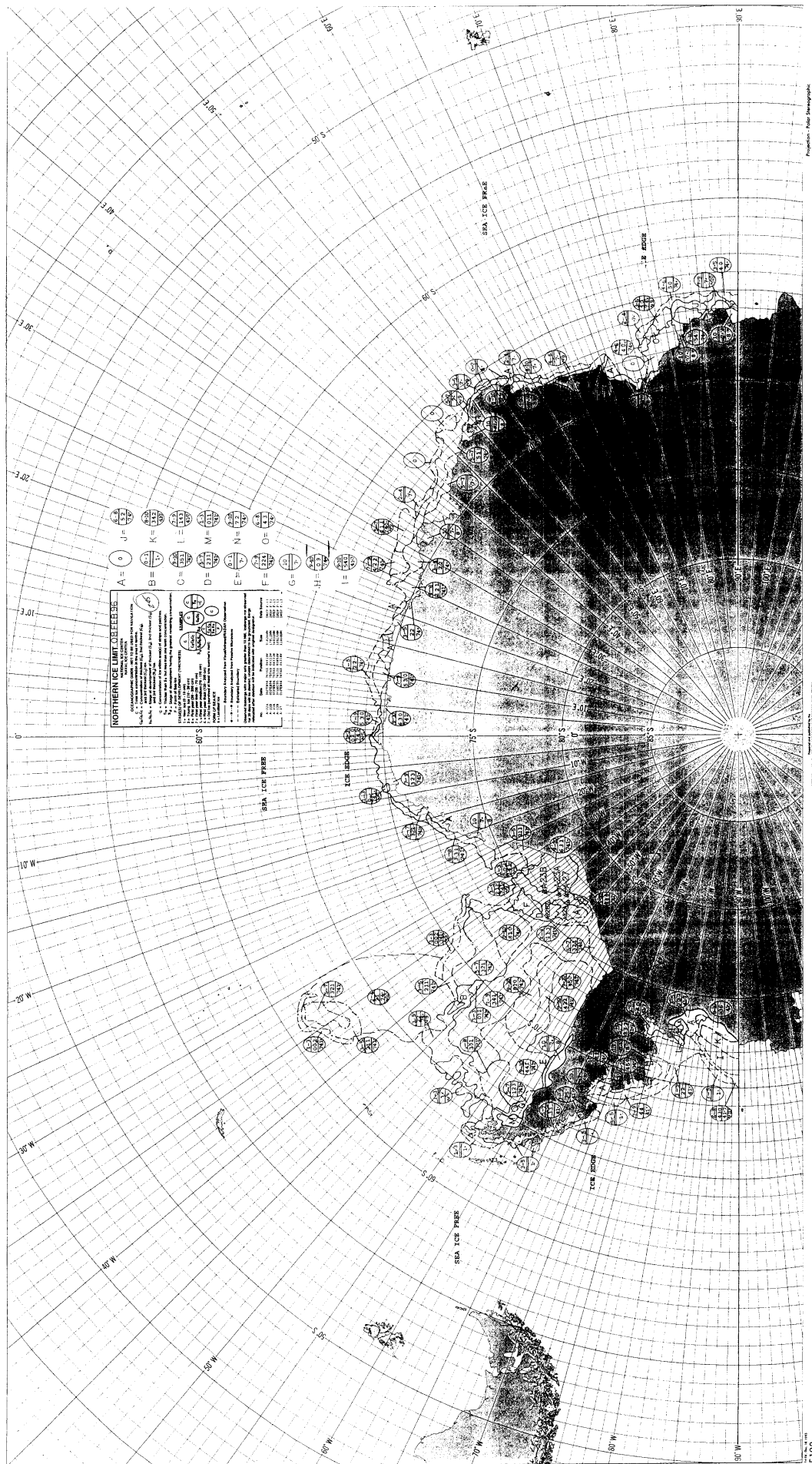
Source: United States Navy  
Date: 1955



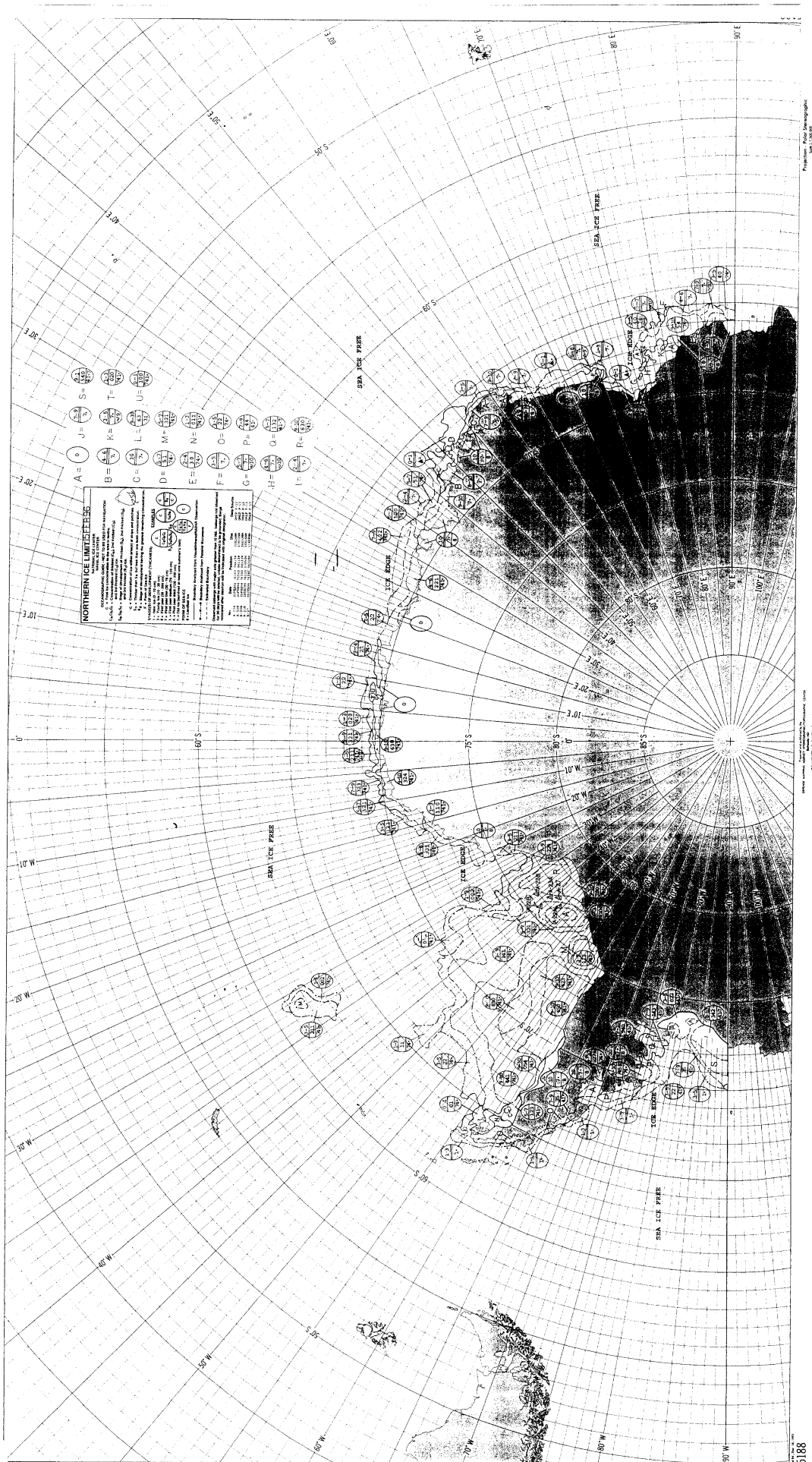










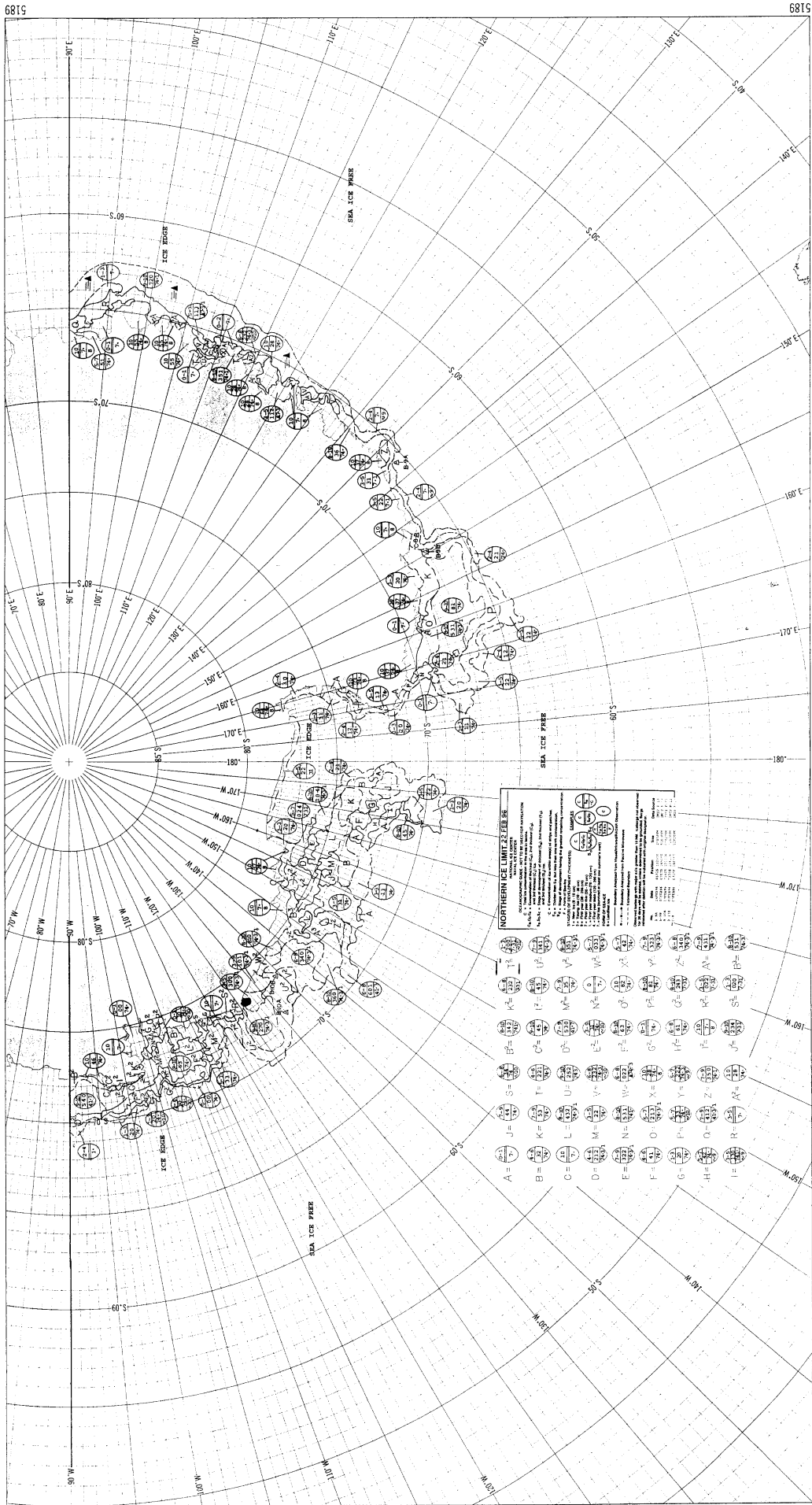


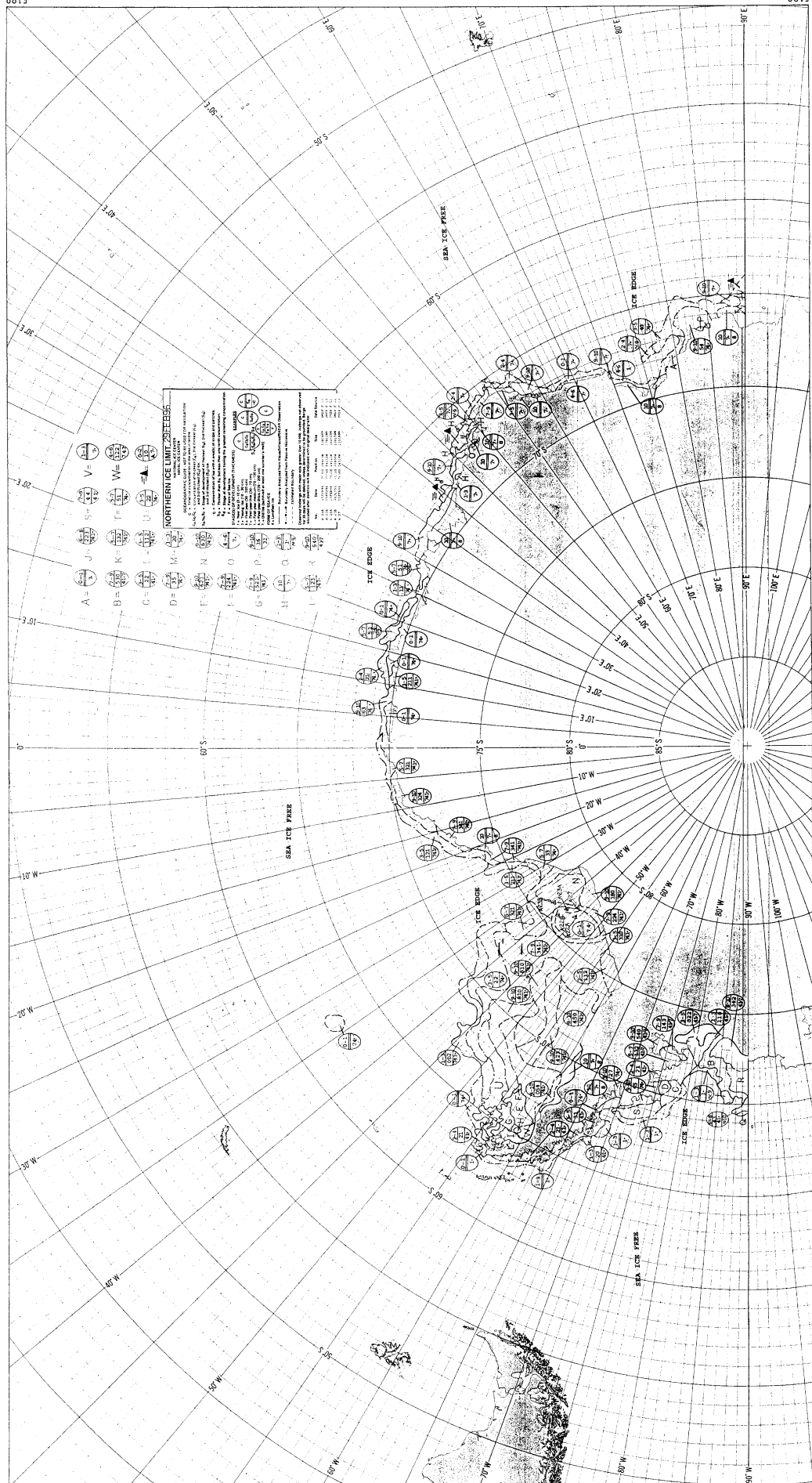










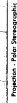


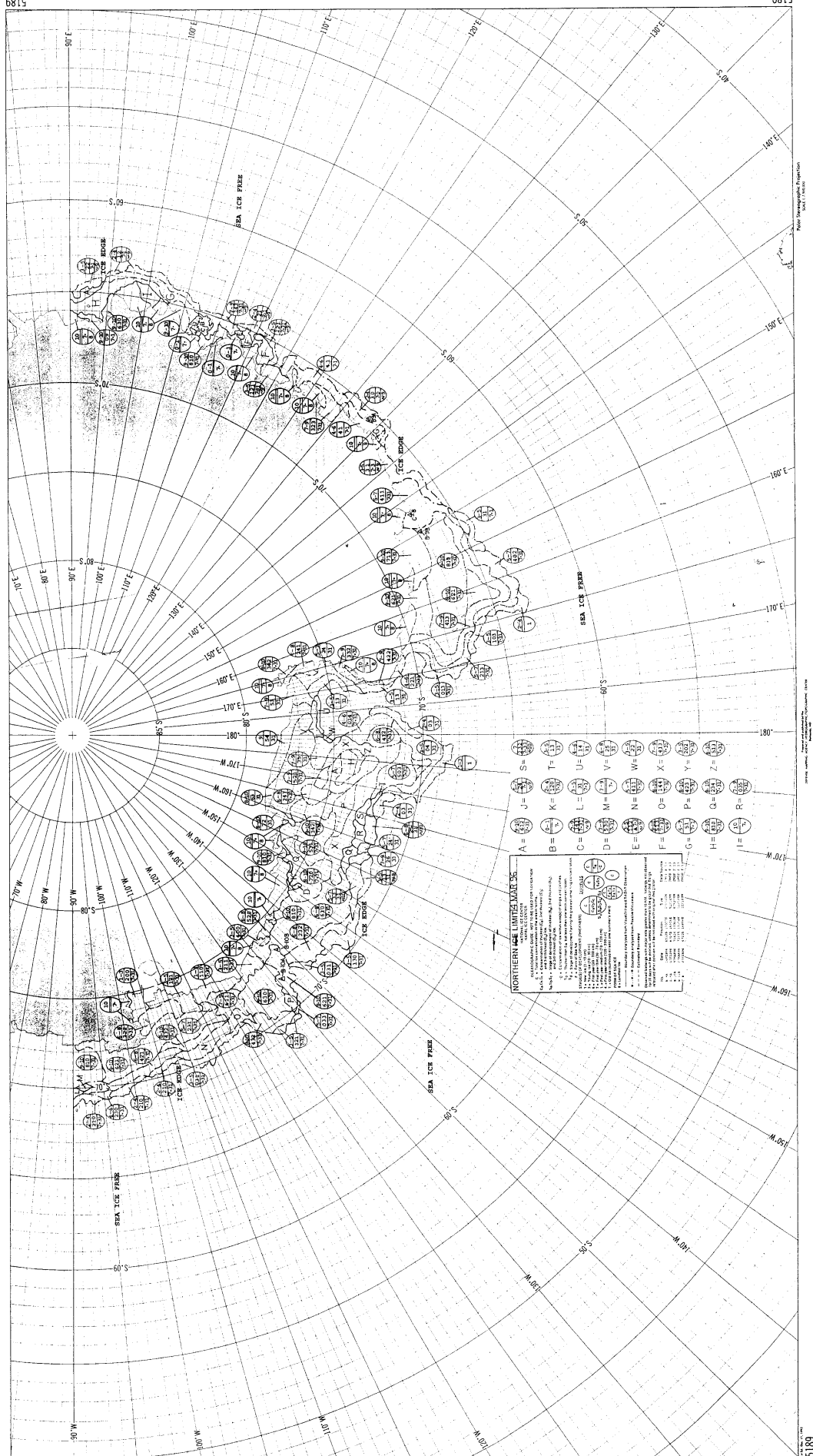


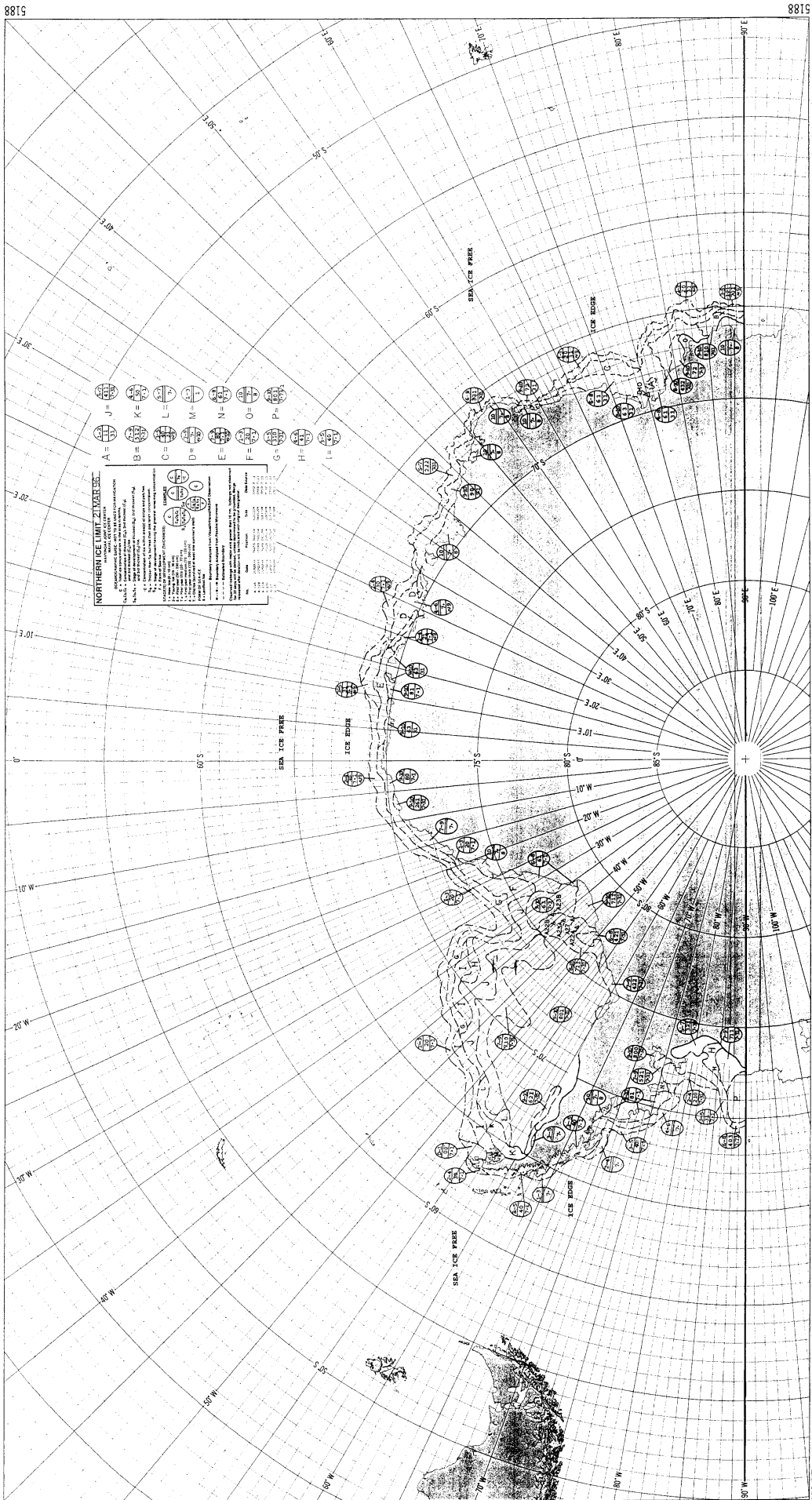


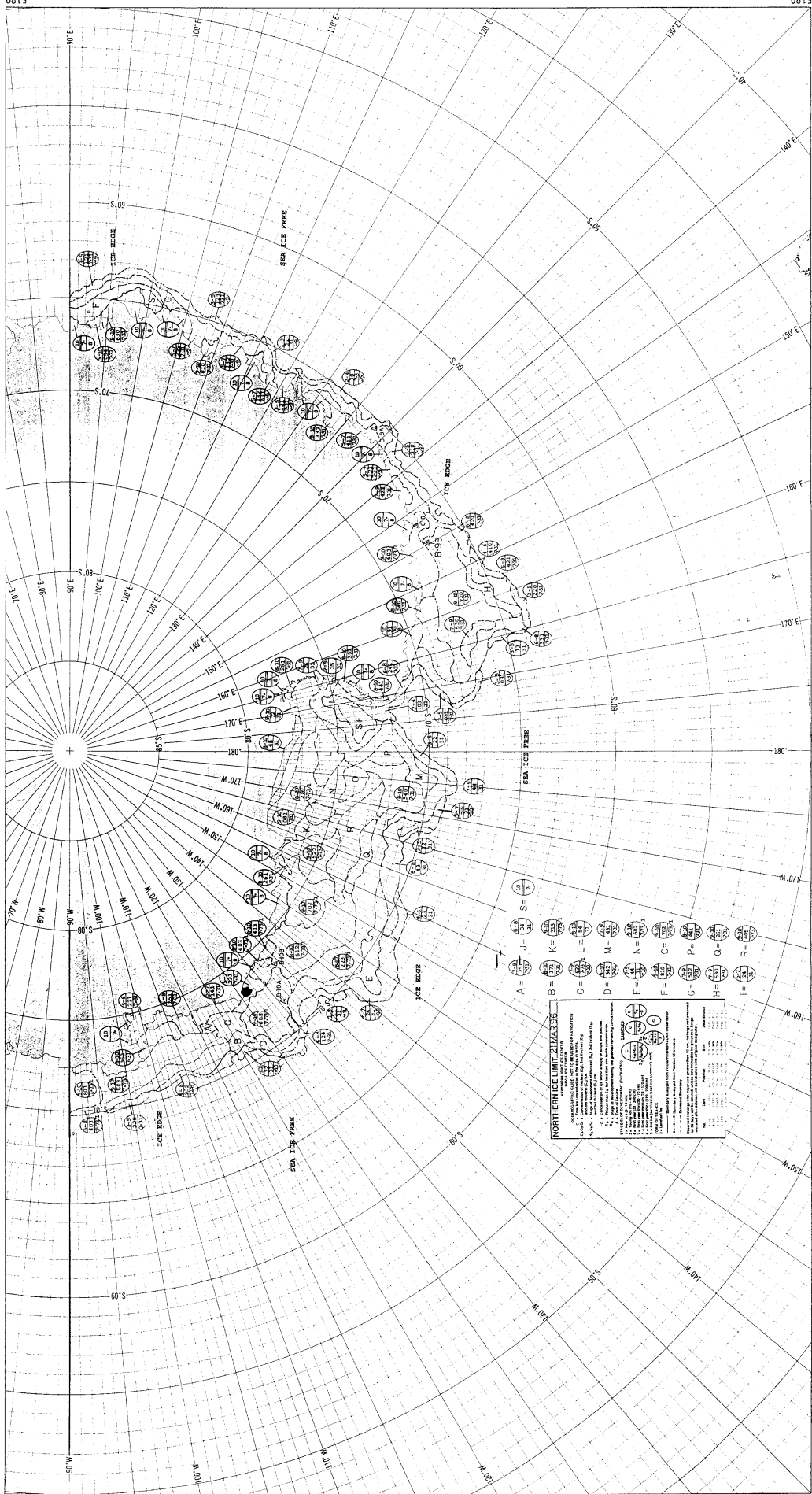


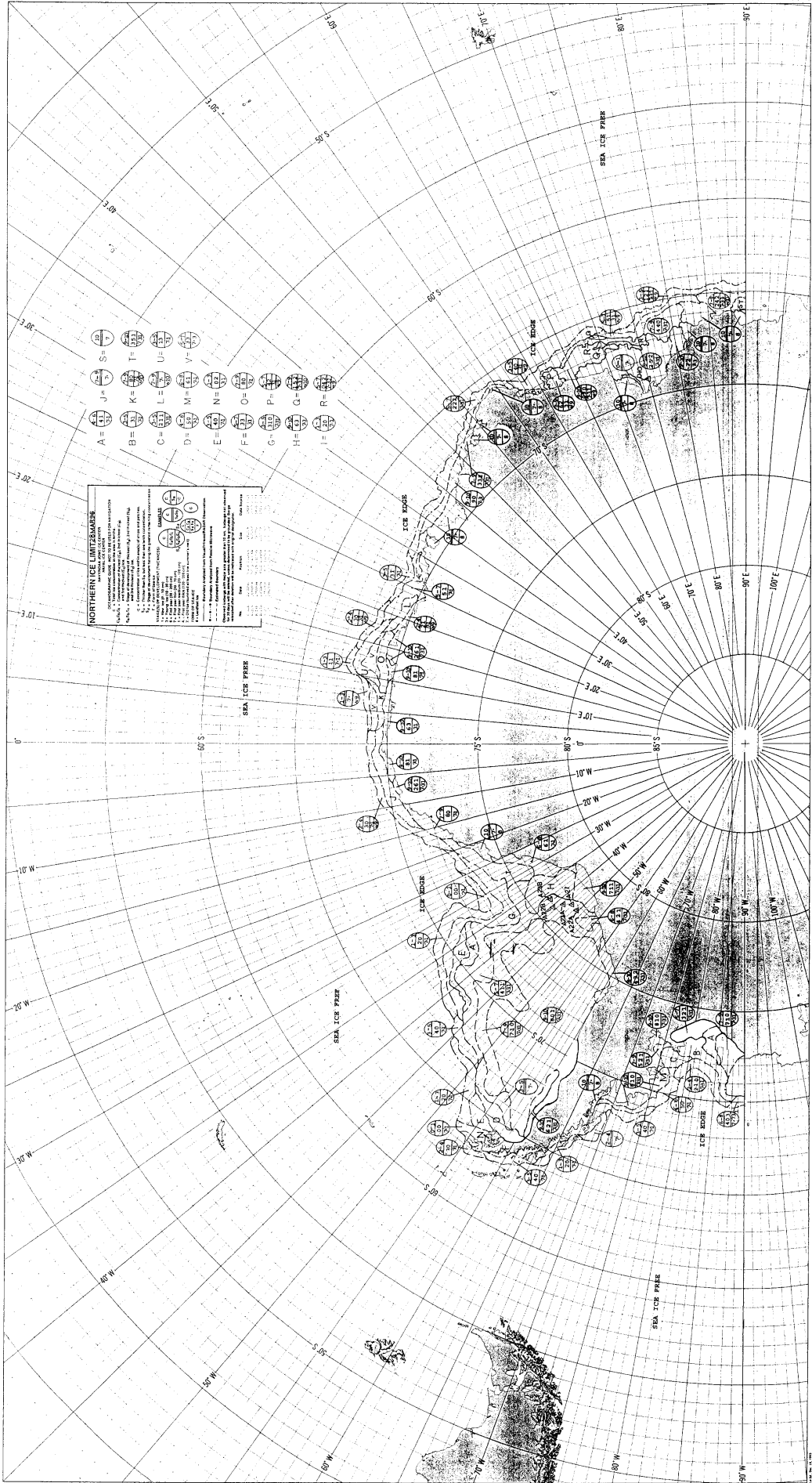






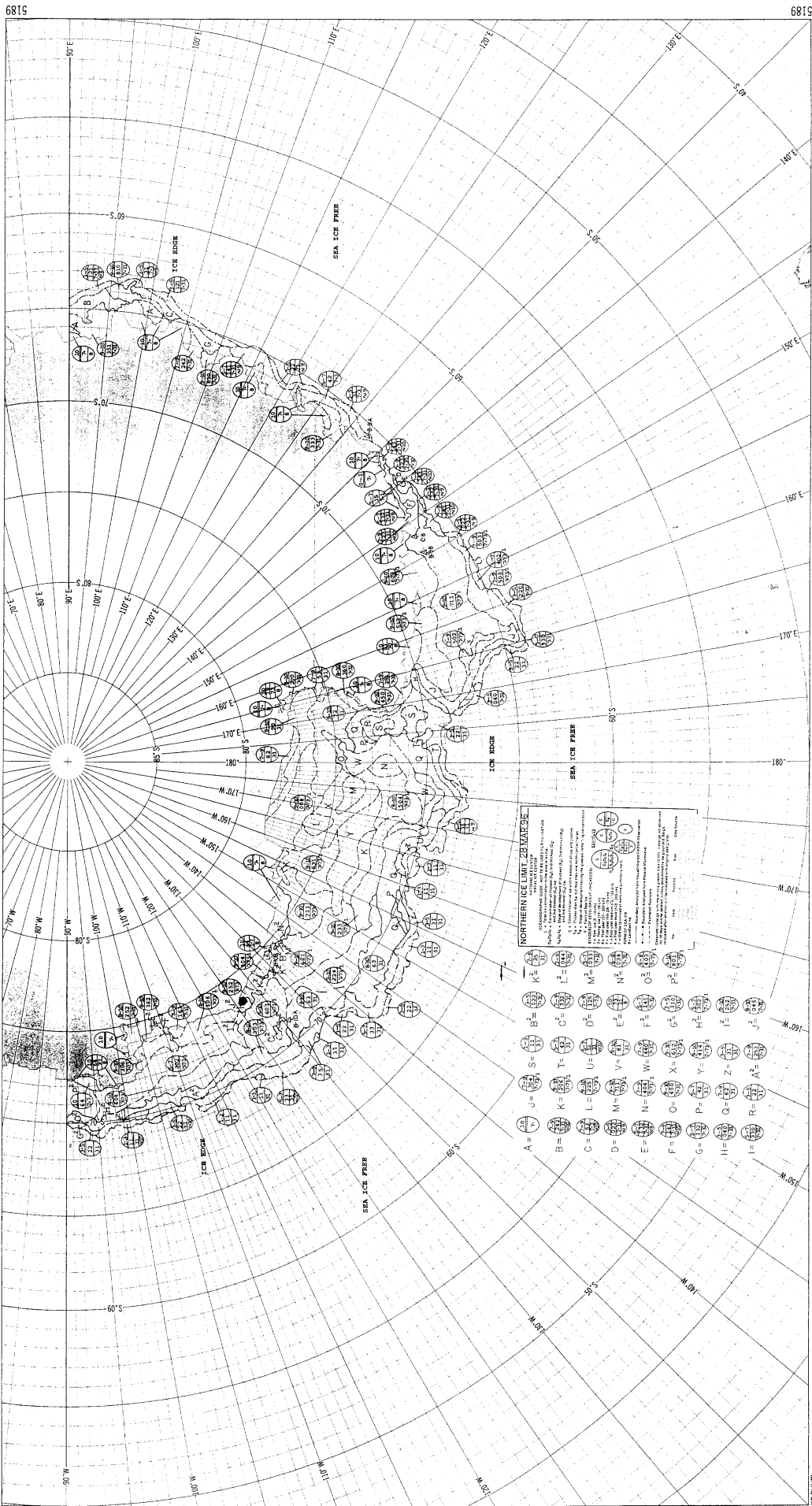






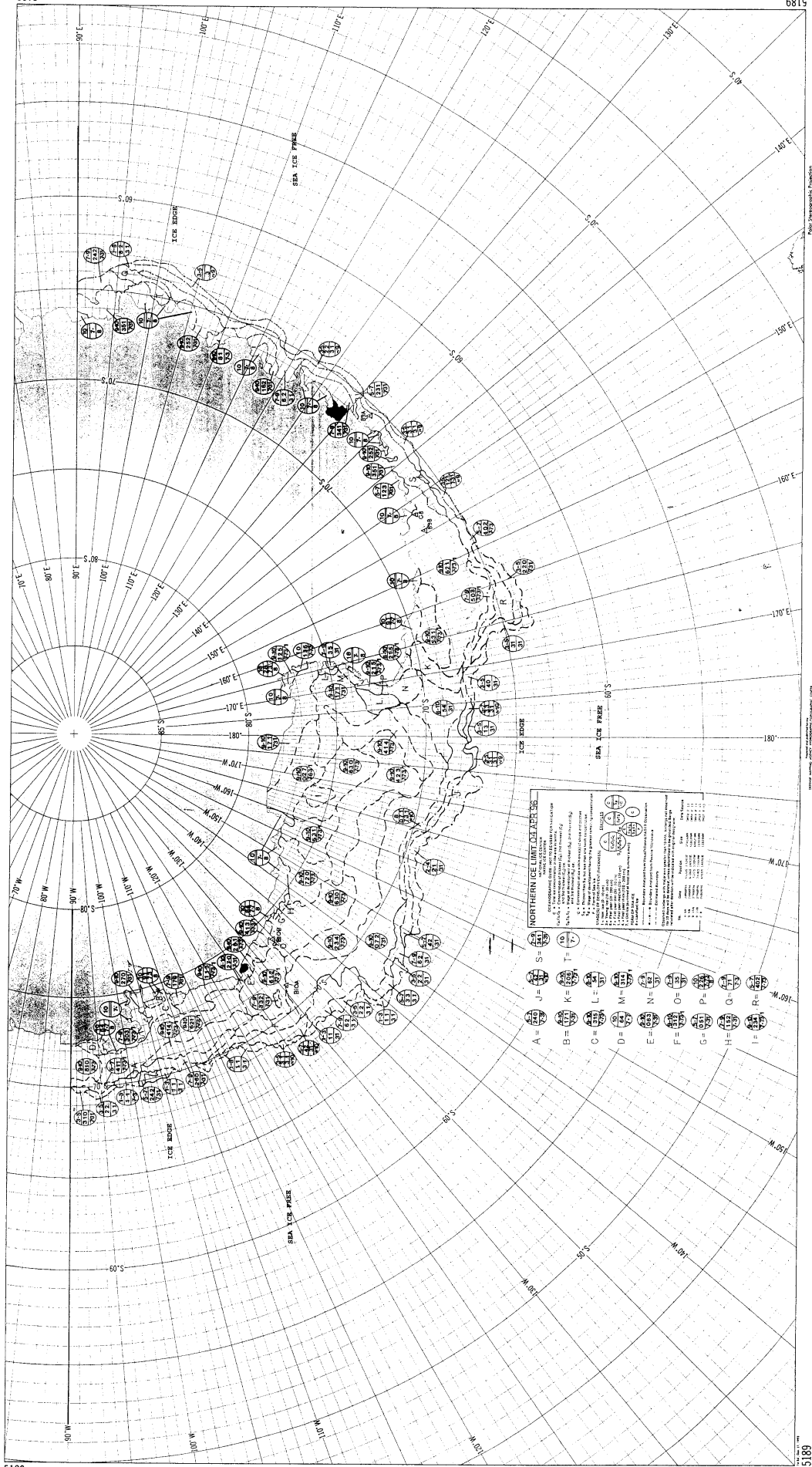
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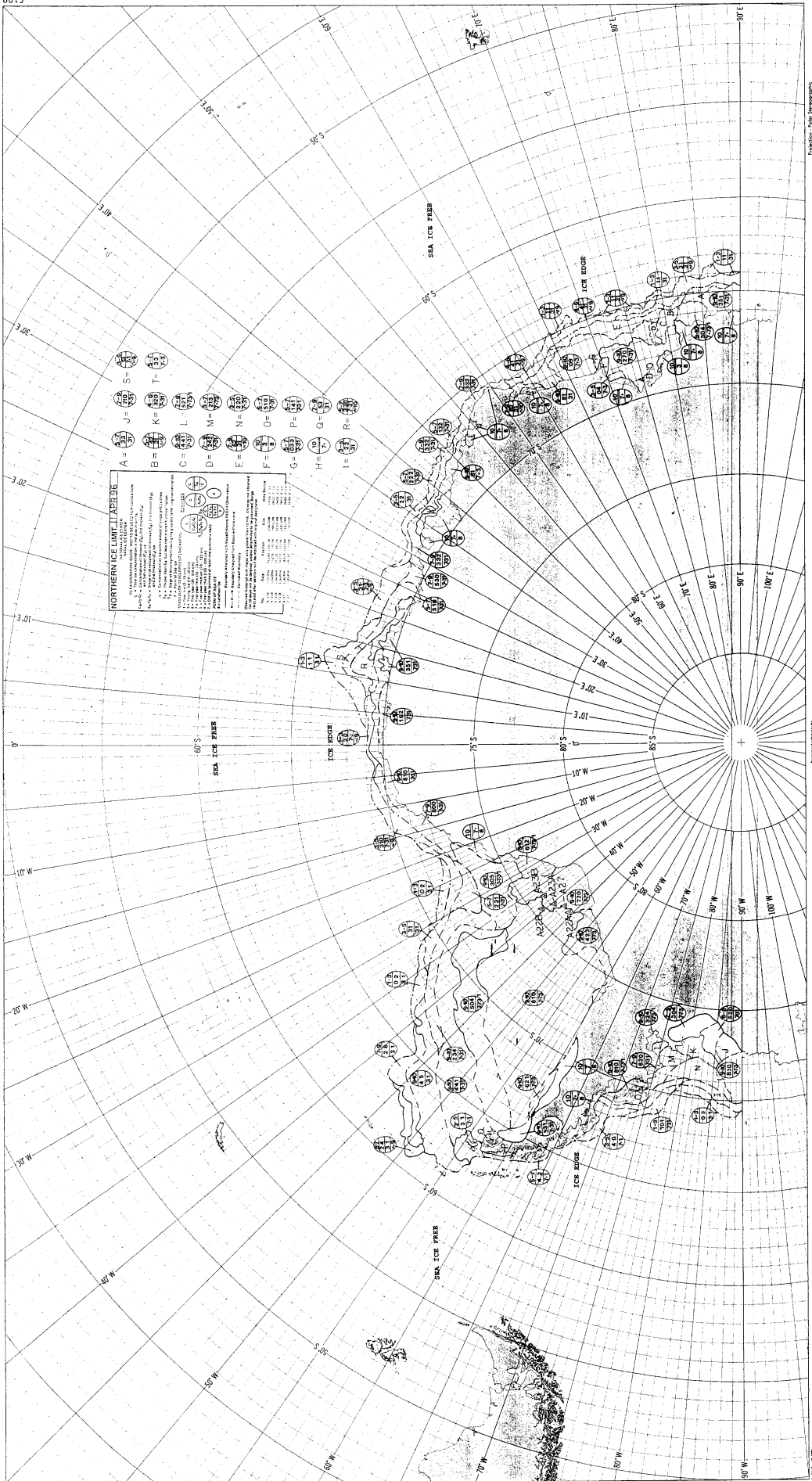
Source: U.S. Navy Hydrographic Office  
Revised: 1980

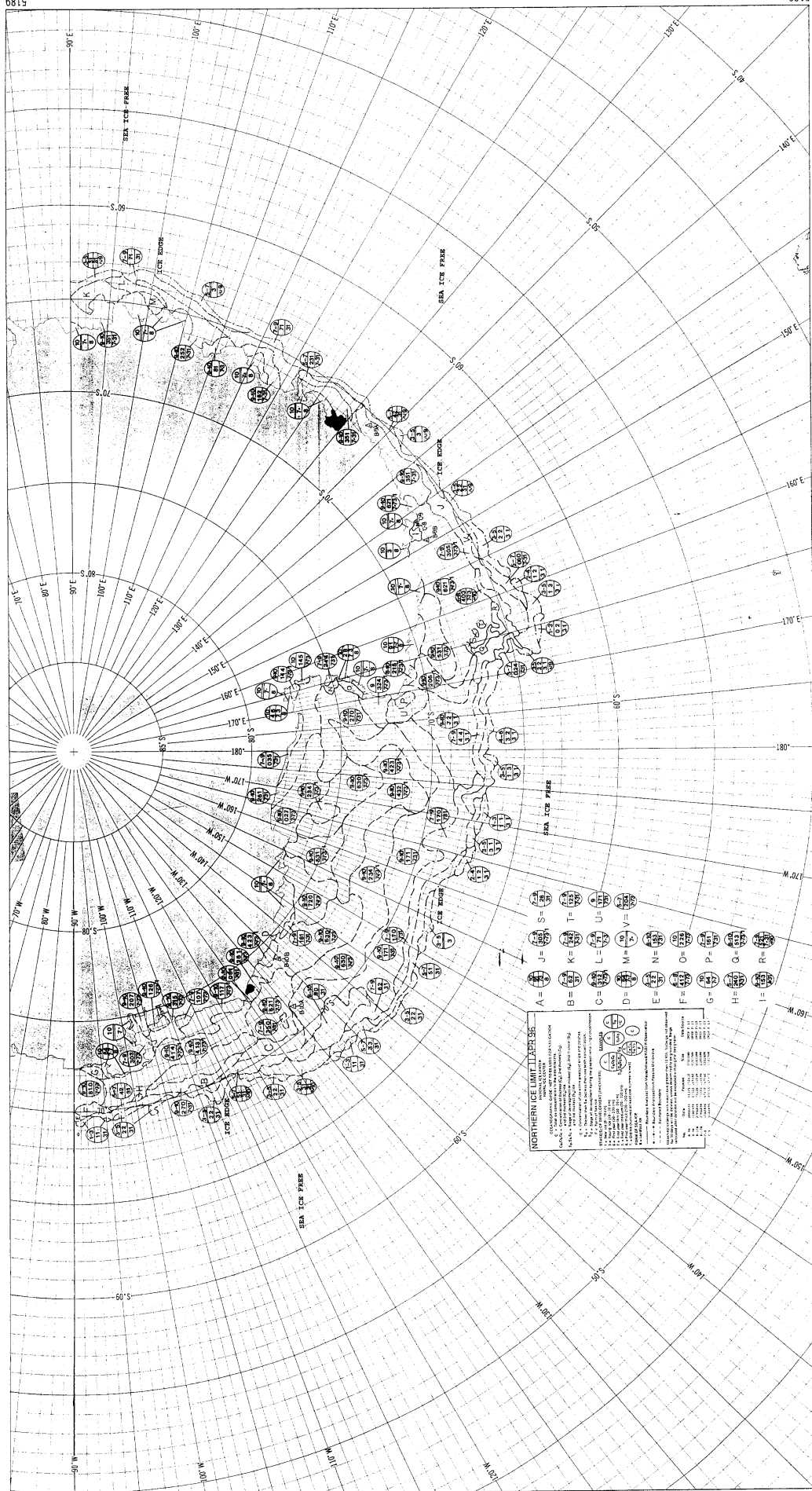




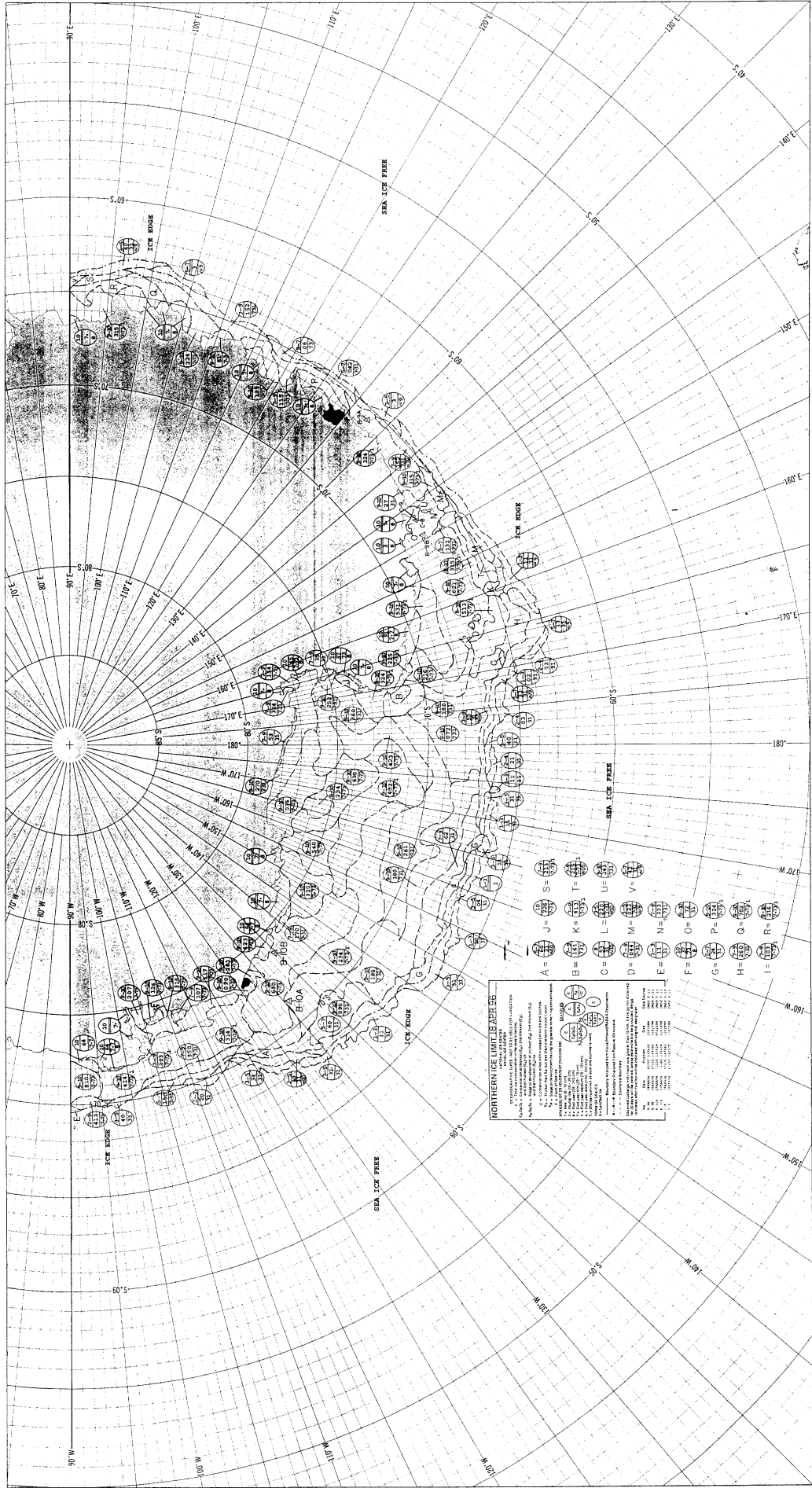




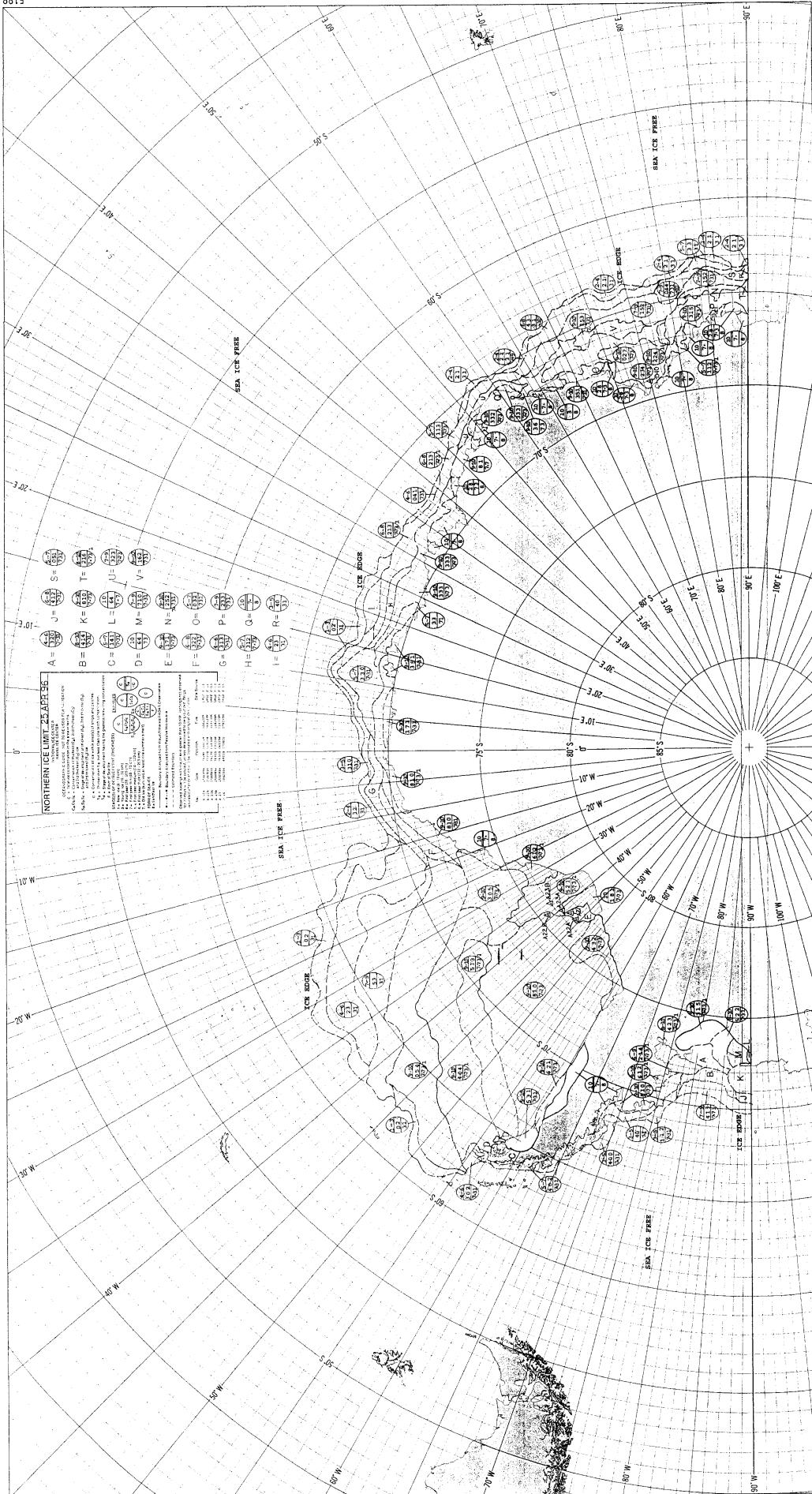


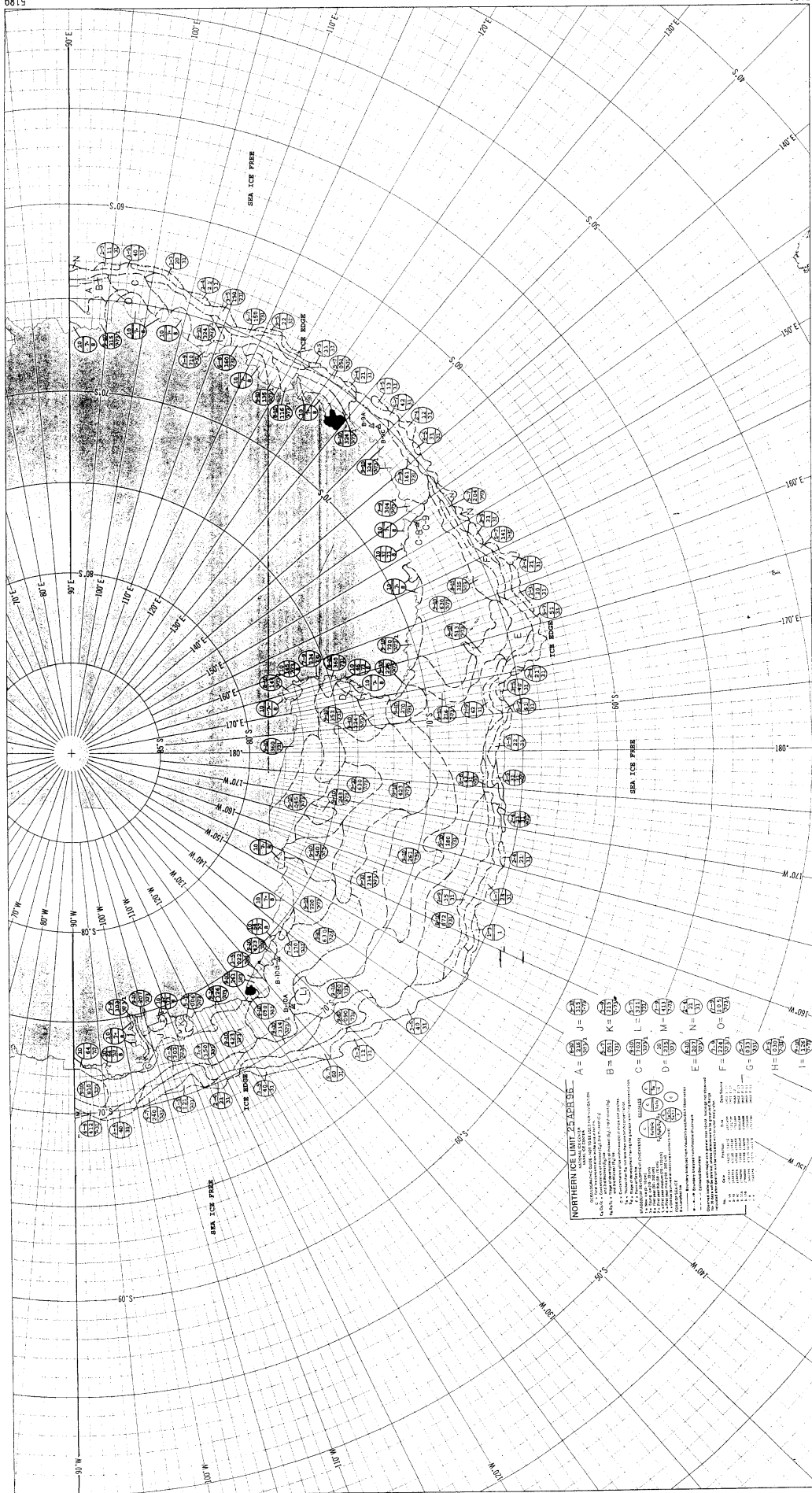


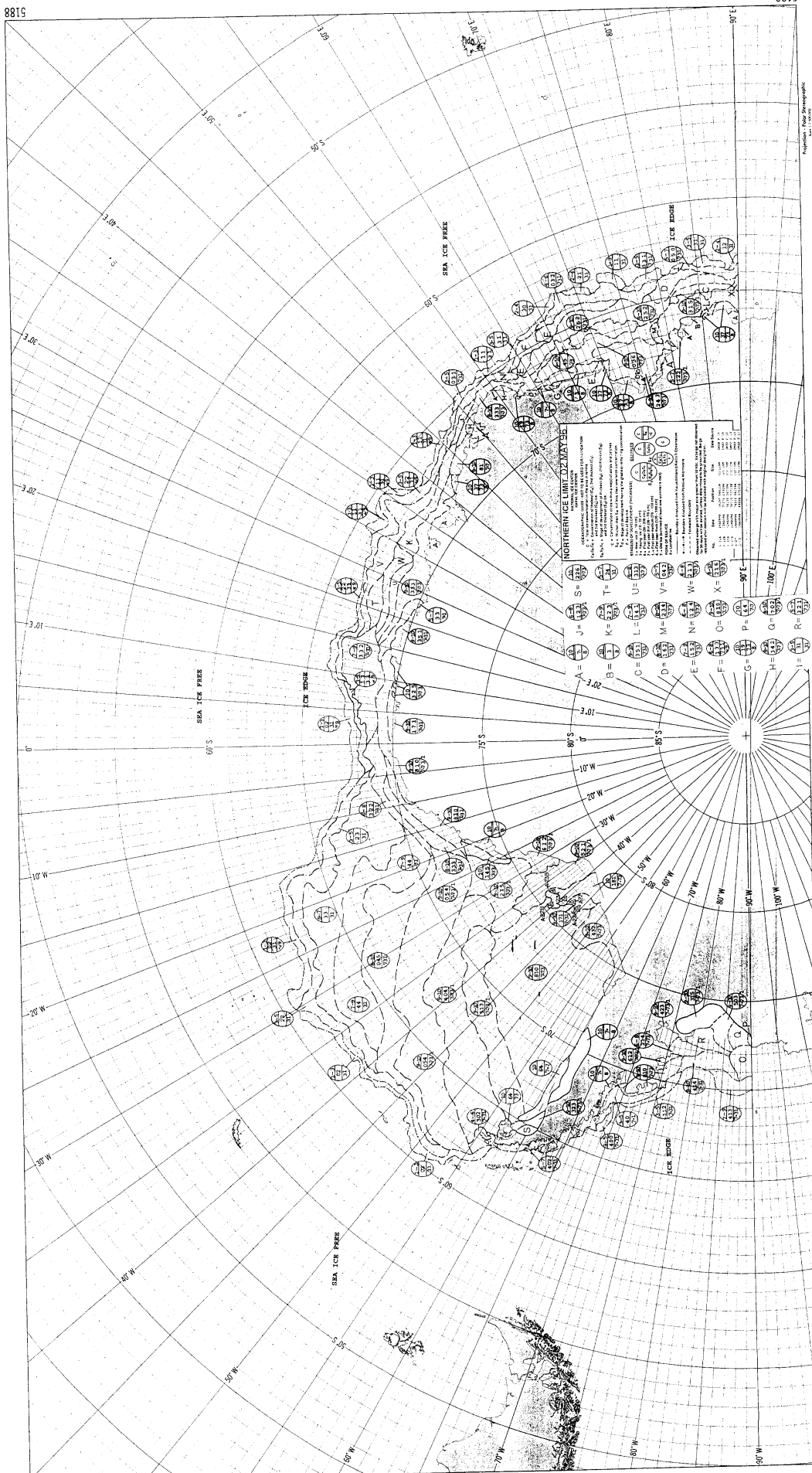






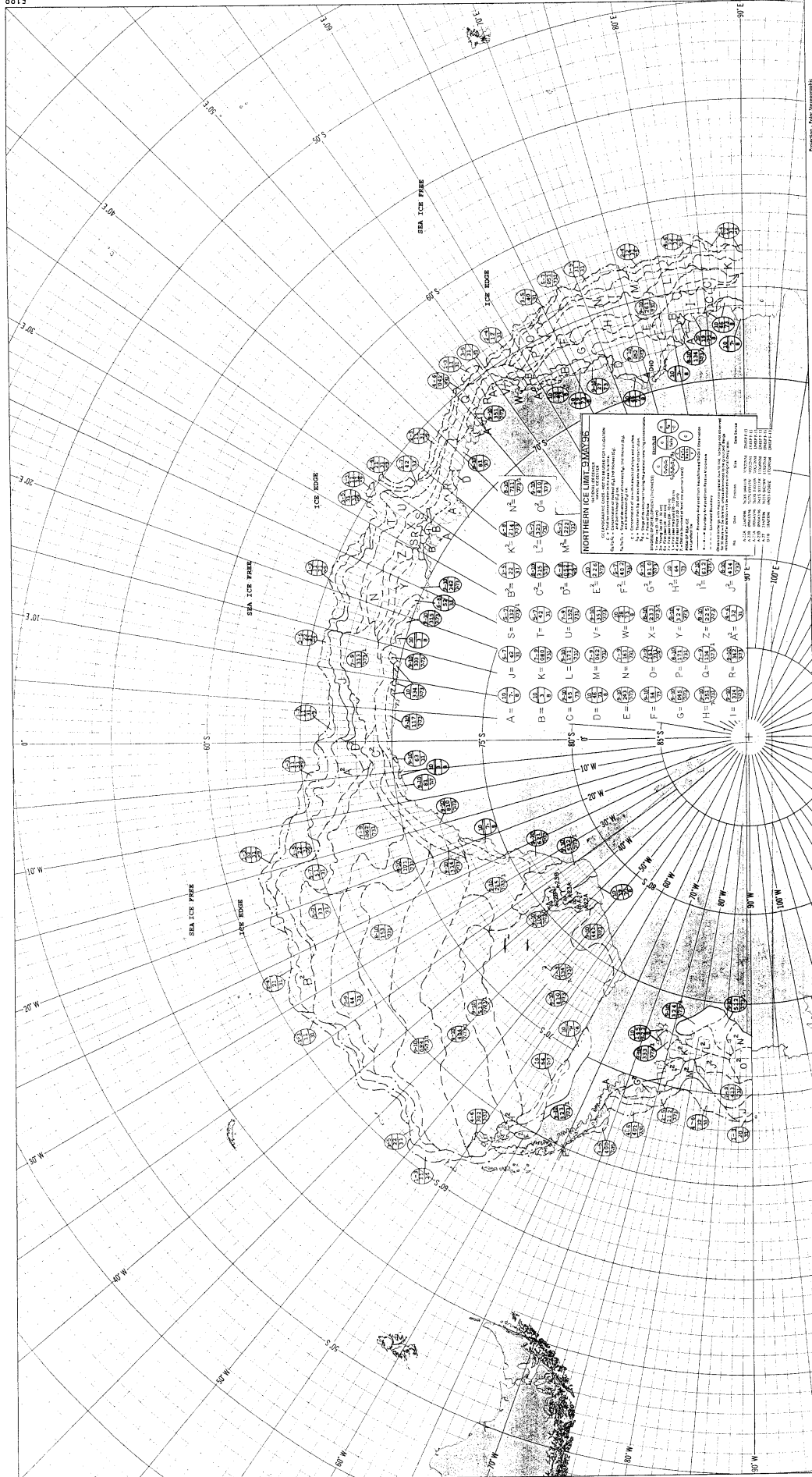


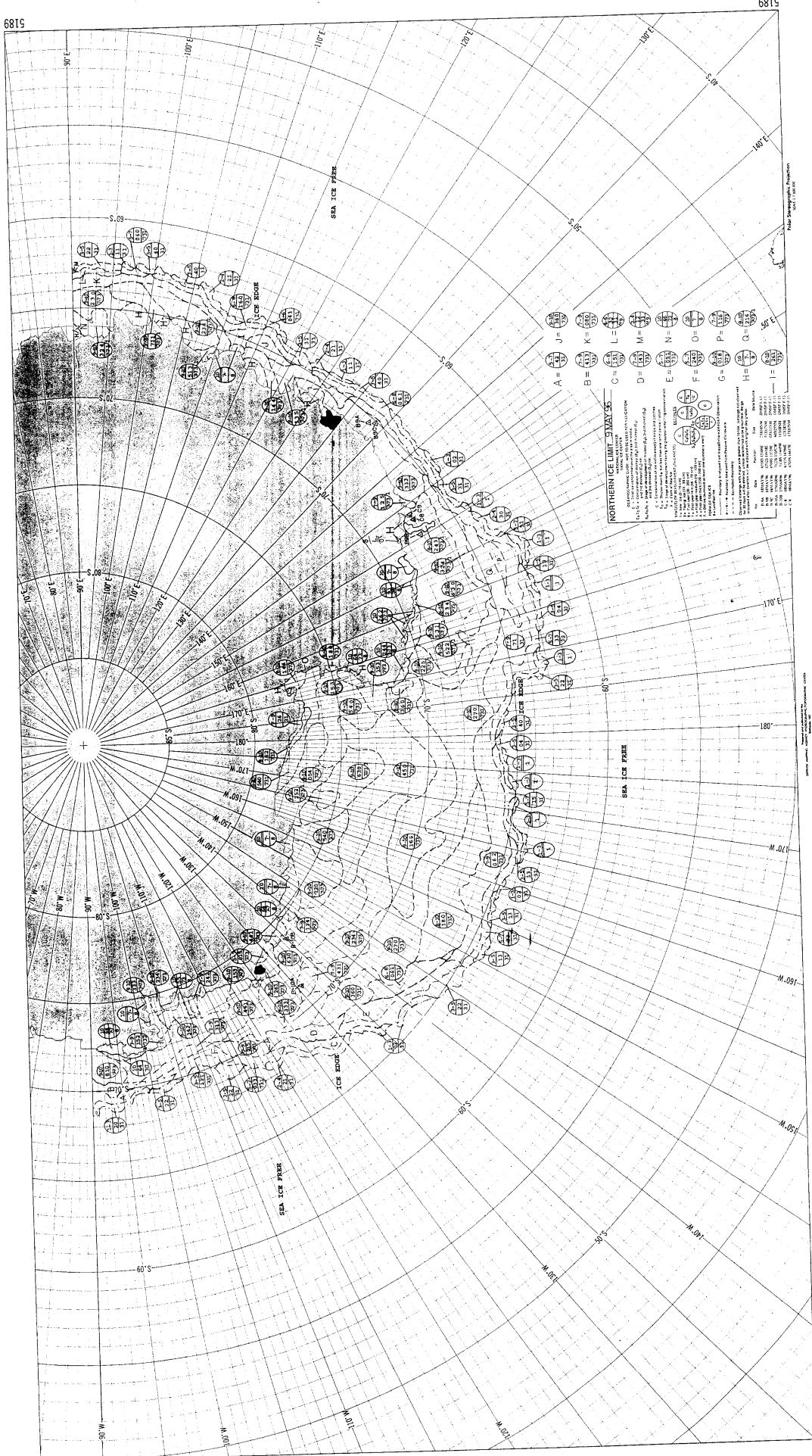




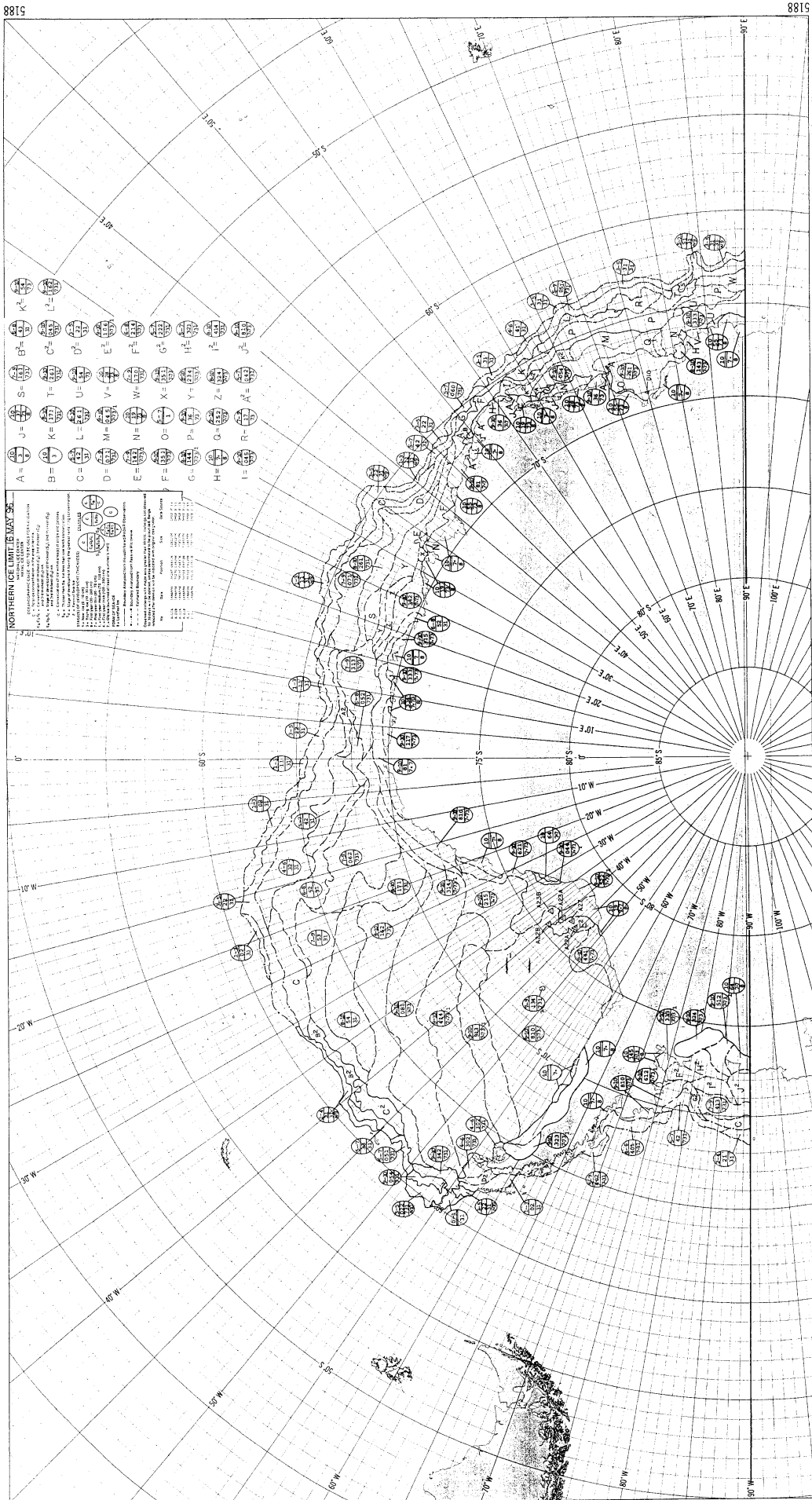
Reprinted from the  
1955 Antarctic Map

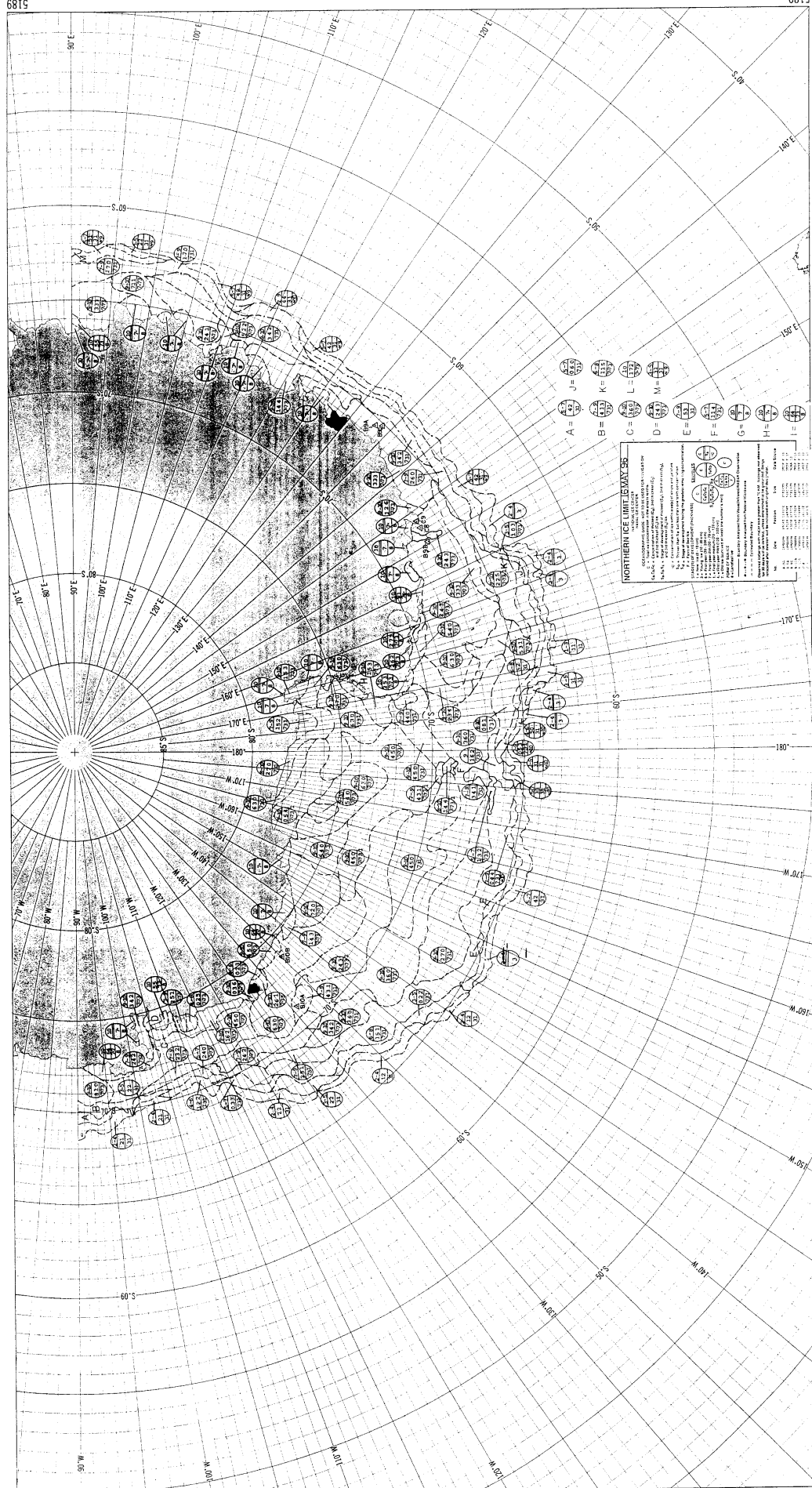


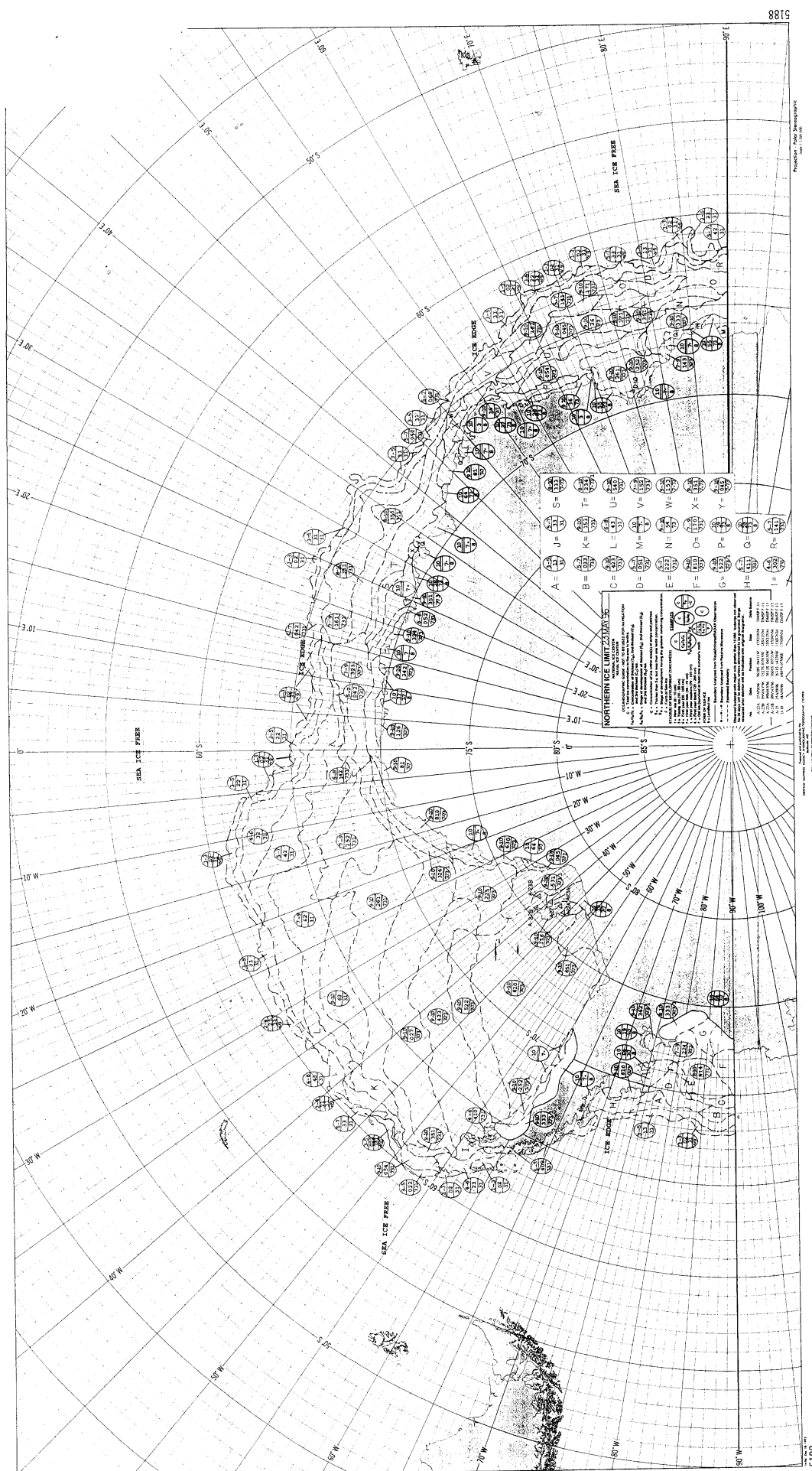












**NORTHERN ICE LIMIT 2000-50**

Legend for Sea Ice Extent and Boundaries:

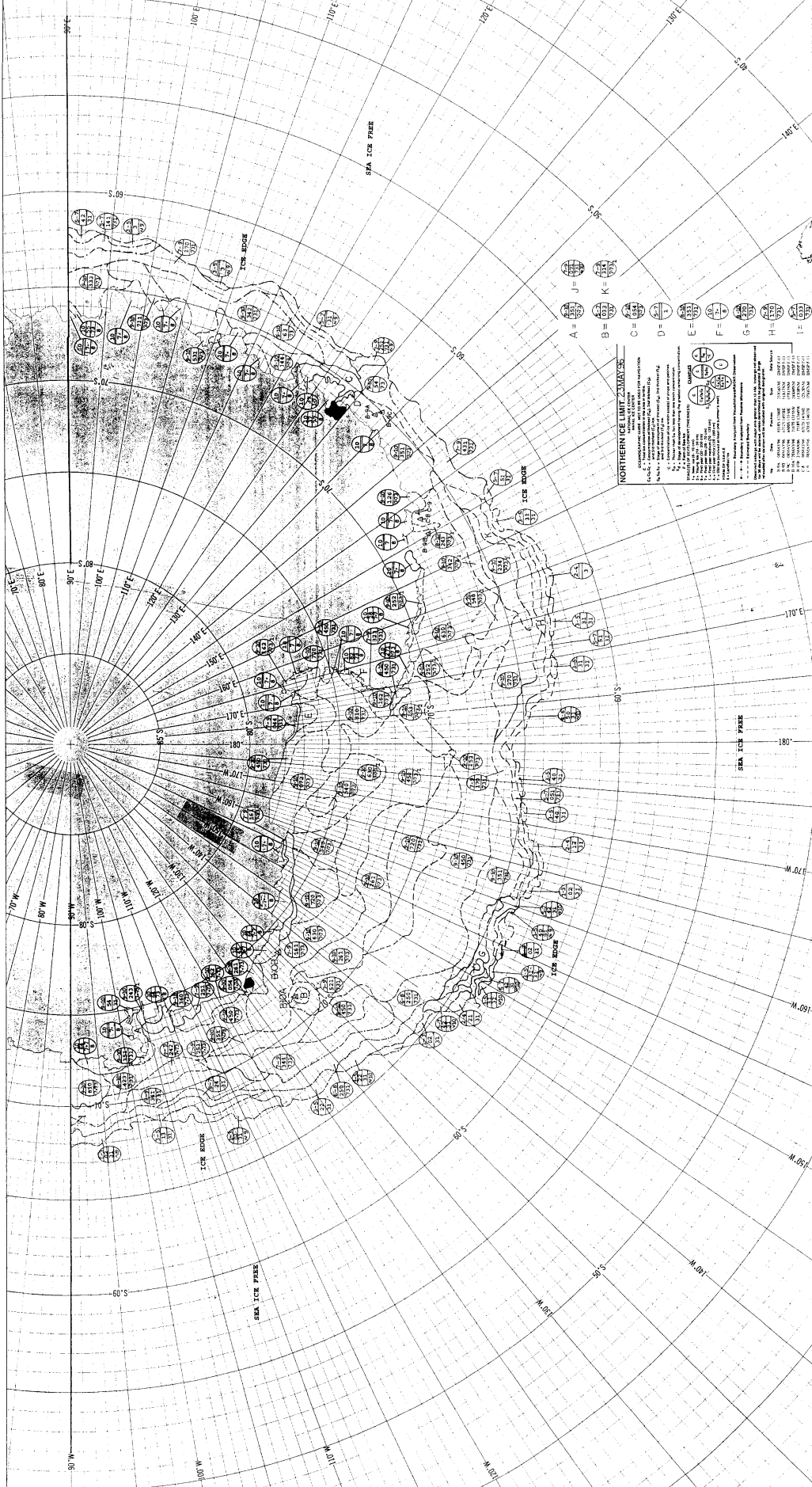
- SEA ICE PERM: Sea Ice Perimeter
- ICE BOUND: Ice Boundary
- NORTHERN ICE LIMIT: Northern Ice Limit

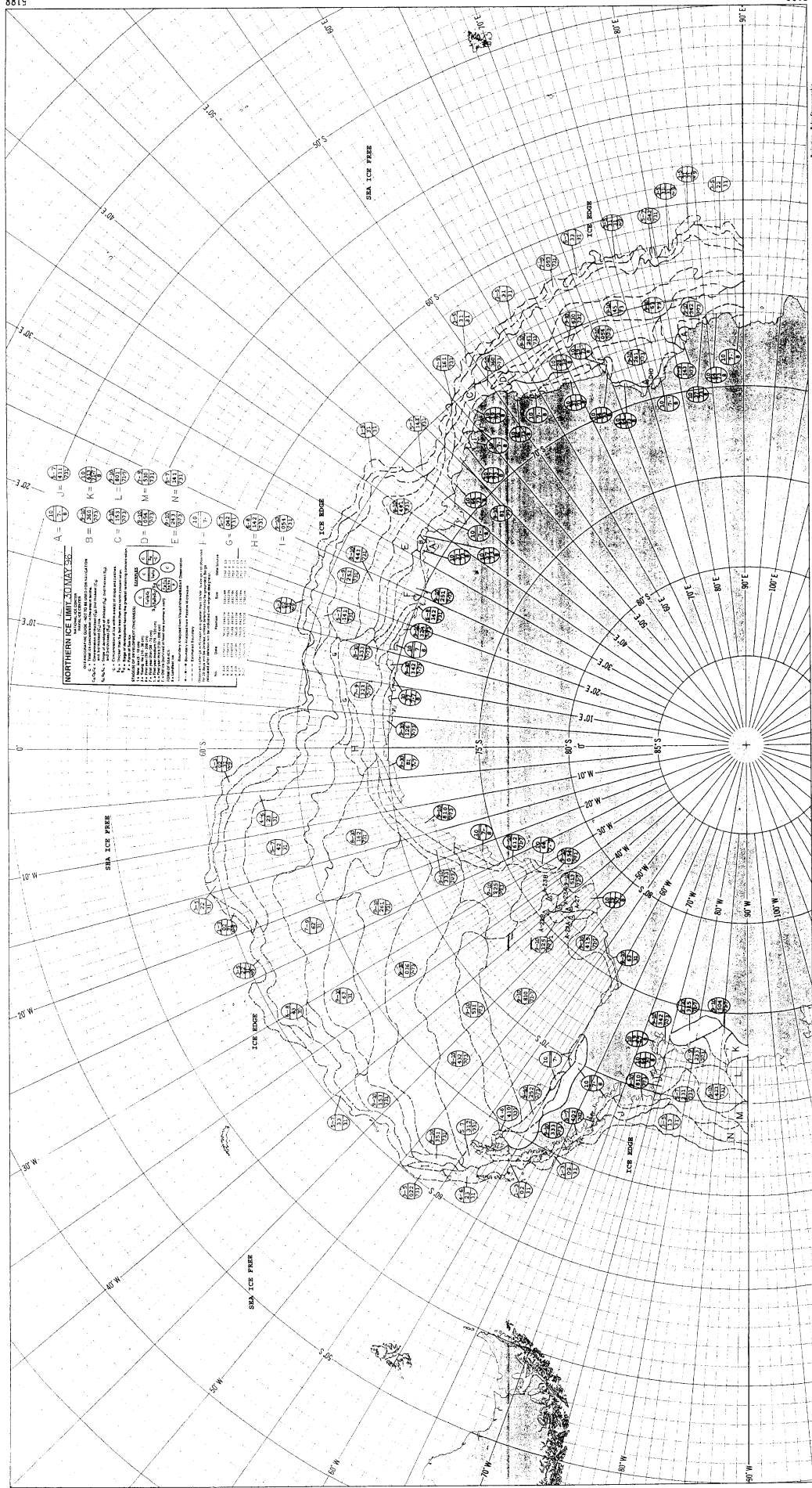
Legend for Sea Ice Extent and Boundaries:

- SEA ICE PERM: Sea Ice Perimeter
- ICE BOUND: Ice Boundary
- NORTHERN ICE LIMIT: Northern Ice Limit

Legend for Sea Ice Extent and Boundaries:

- SEA ICE PERM: Sea Ice Perimeter
- ICE BOUND: Ice Boundary
- NORTHERN ICE LIMIT: Northern Ice Limit





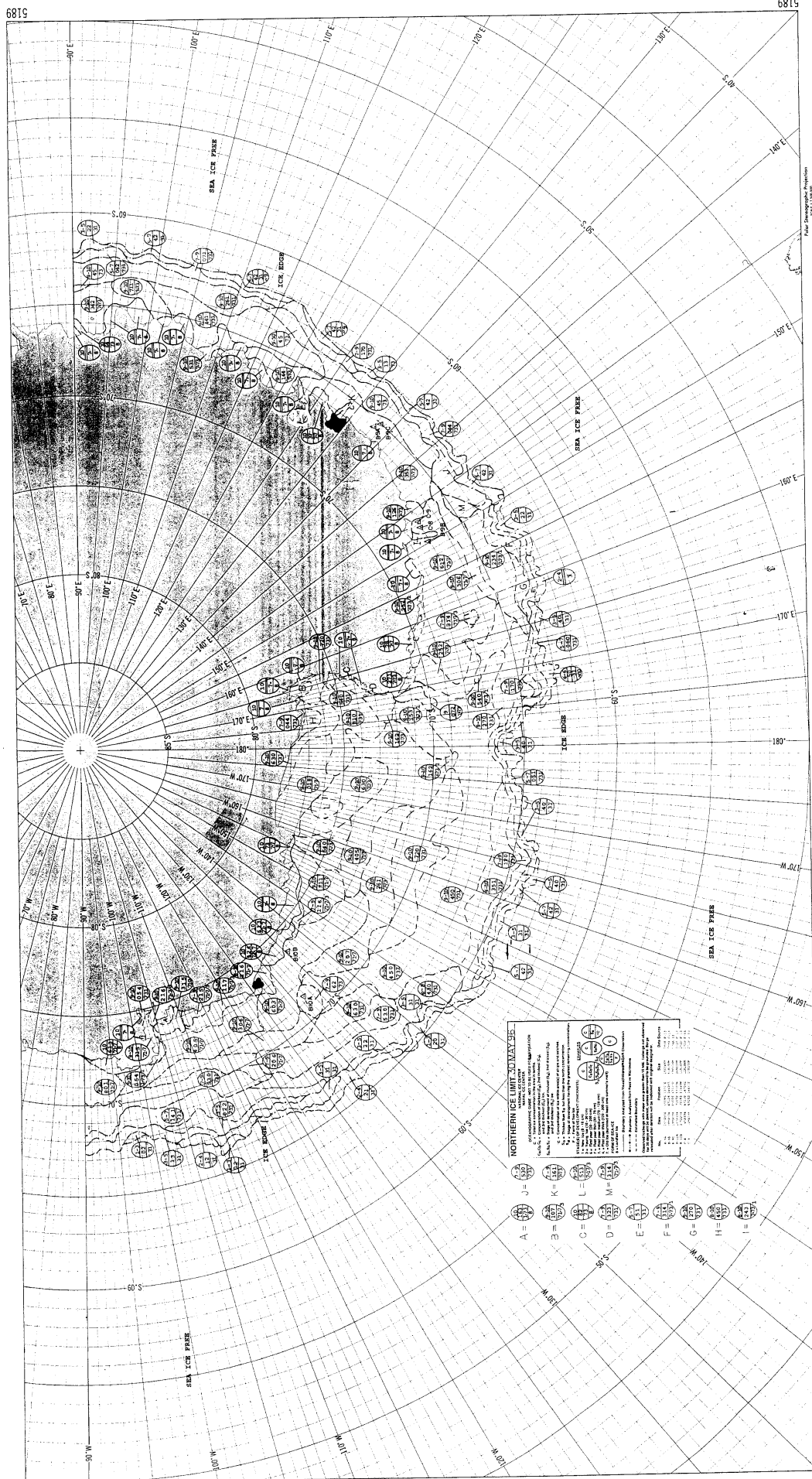
**NORTHERN ICE LIMIT 30 MAY 55**

1. This chart shows the northern limit of sea ice in the Arctic Ocean as of 30 May 1955. The limit is based on observations from the U.S.S.R. and the U.S. Navy. The limit is shown as a solid line, with dashed lines indicating the probable limit. The limit is shown for the entire Arctic Ocean, including the Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, and Chukchi Sea. The limit is shown for the entire Arctic Ocean, including the Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, and Chukchi Sea. The limit is shown for the entire Arctic Ocean, including the Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, and Chukchi Sea.

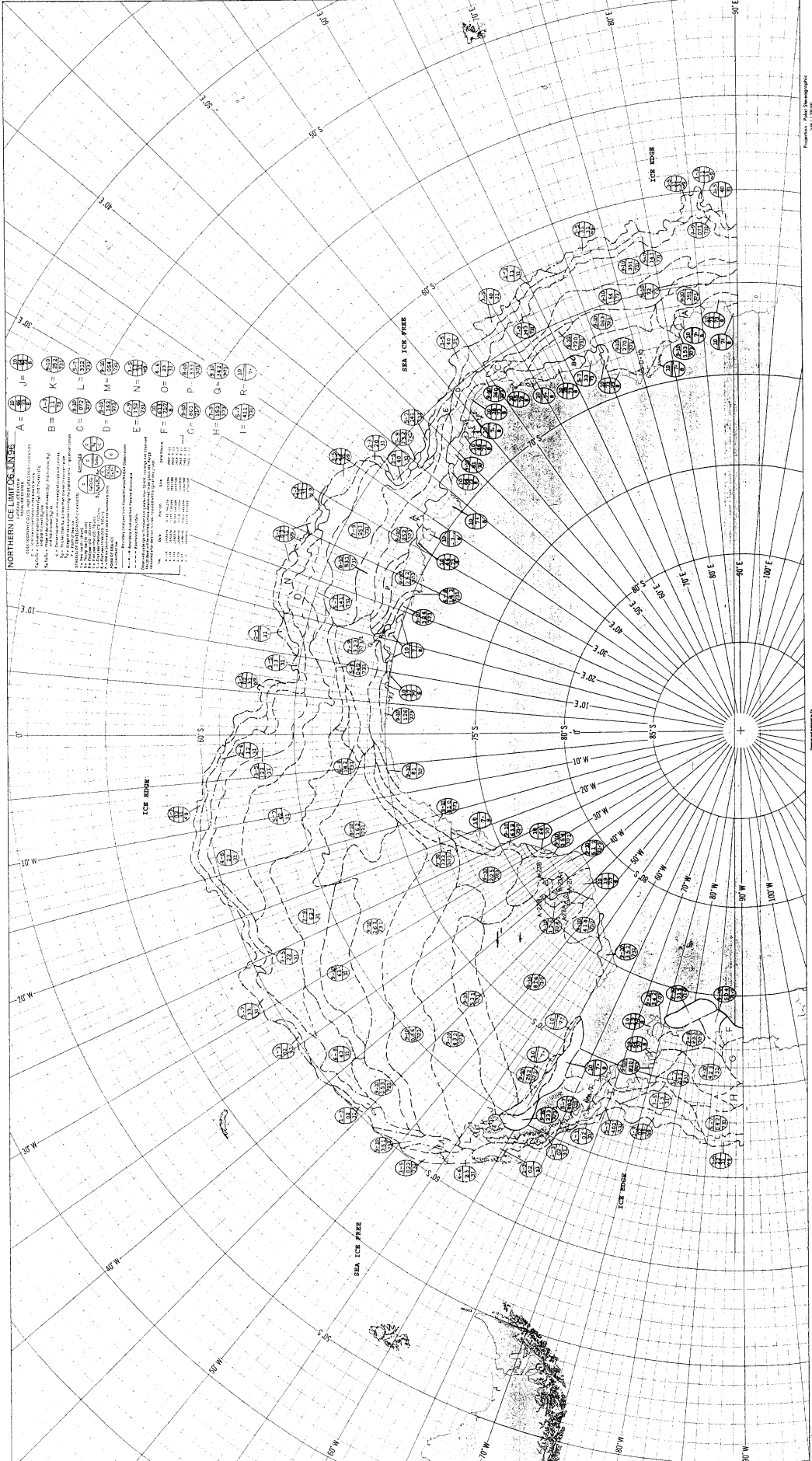
Letter	Number	Meaning
A	1	100% ice
B	1	90% ice
C	1	80% ice
D	1	70% ice
E	1	60% ice
F	1	50% ice
G	1	40% ice
H	1	30% ice
I	1	20% ice
J	1	10% ice
K	1	5% ice
L	1	1% ice
M	1	0% ice
N	1	Sea ice free

Projection: Polar Stereographic  
Scale: 1:100,000

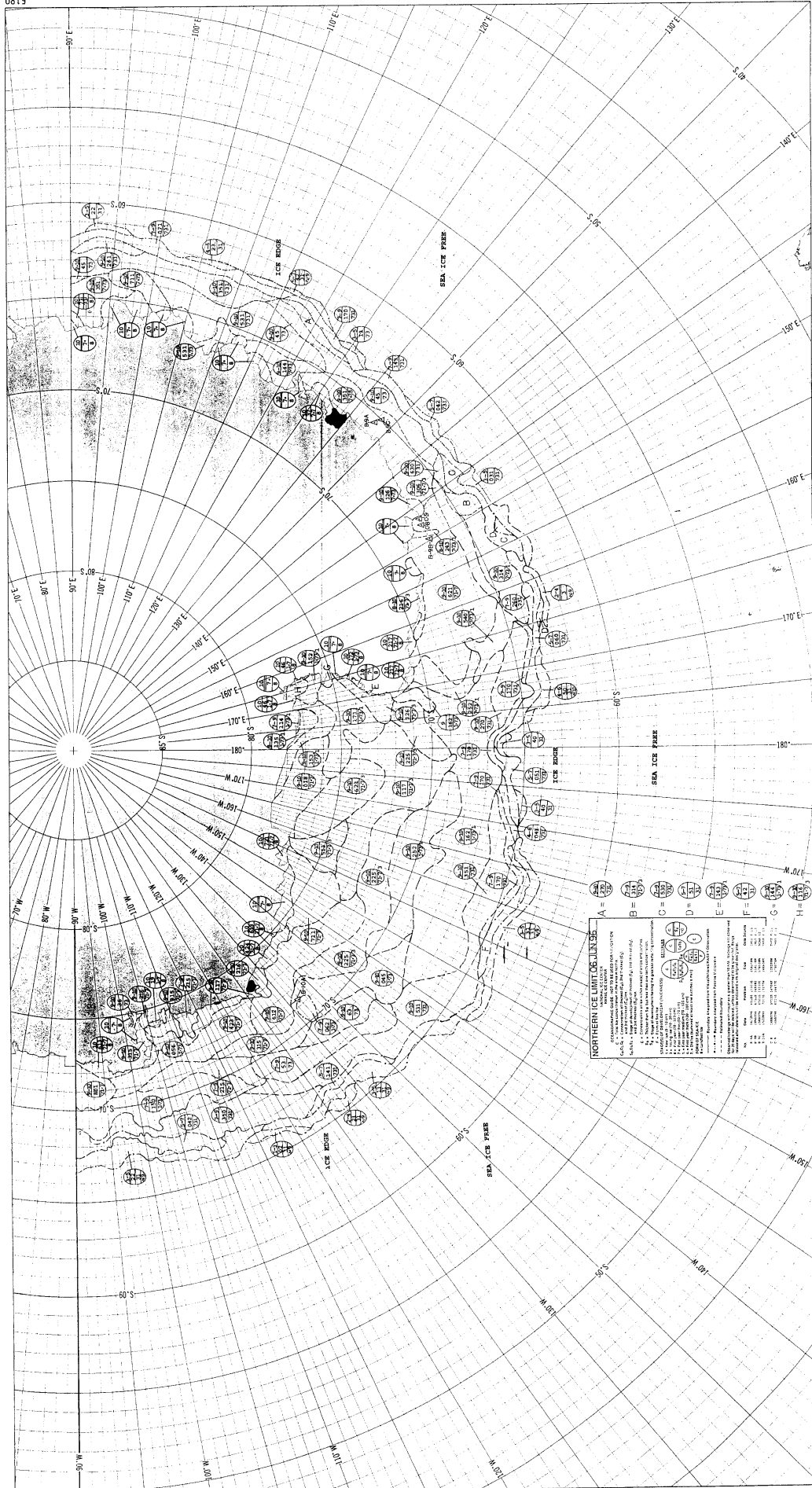
Source: U.S. Navy Hydrographic Office  
Date: 1 May 1955







Prepared by Arctic Research Society  
1951



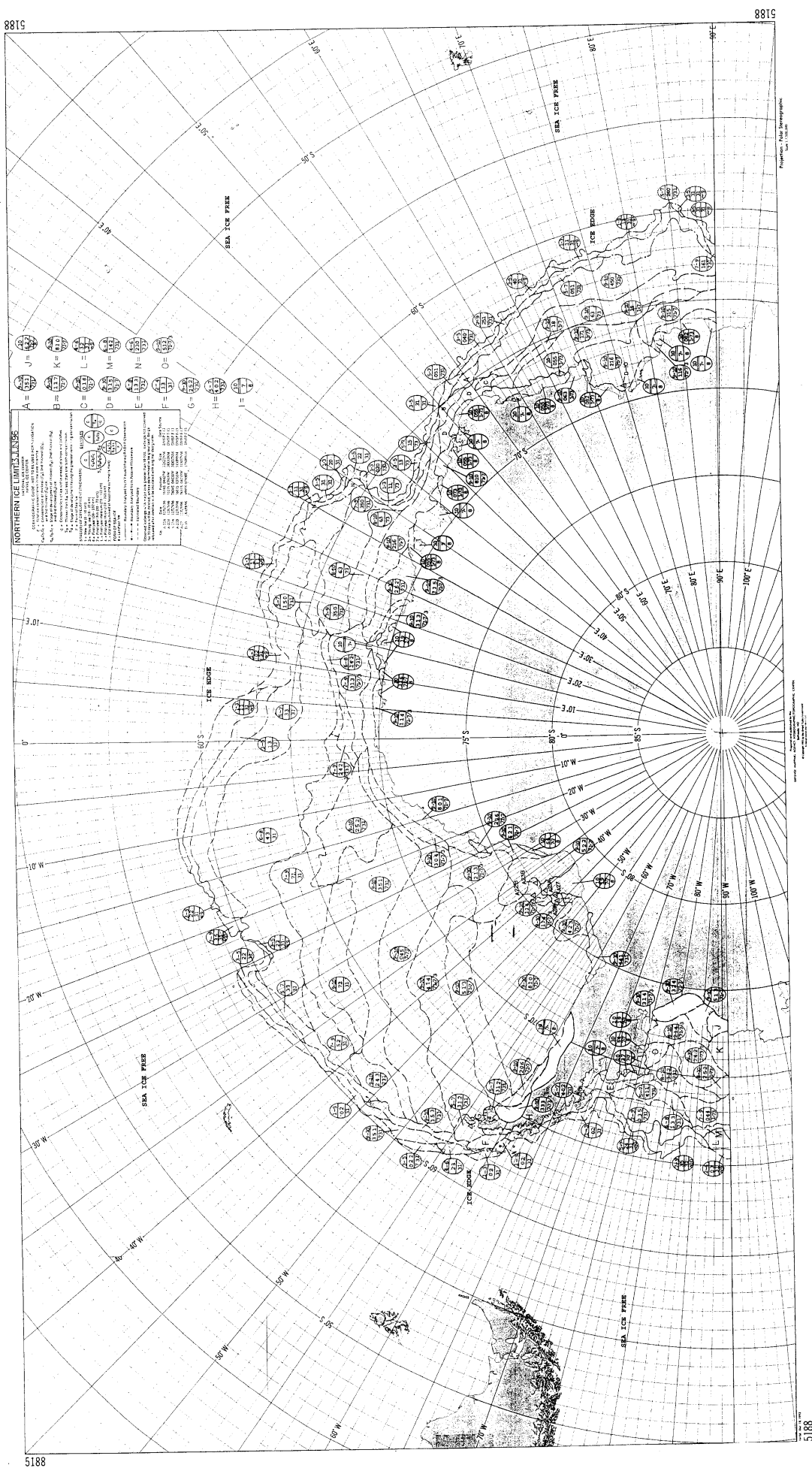
**NORTHERN LIMIT OF SEA ICE**

1. The limit of sea ice is determined by the following factors:

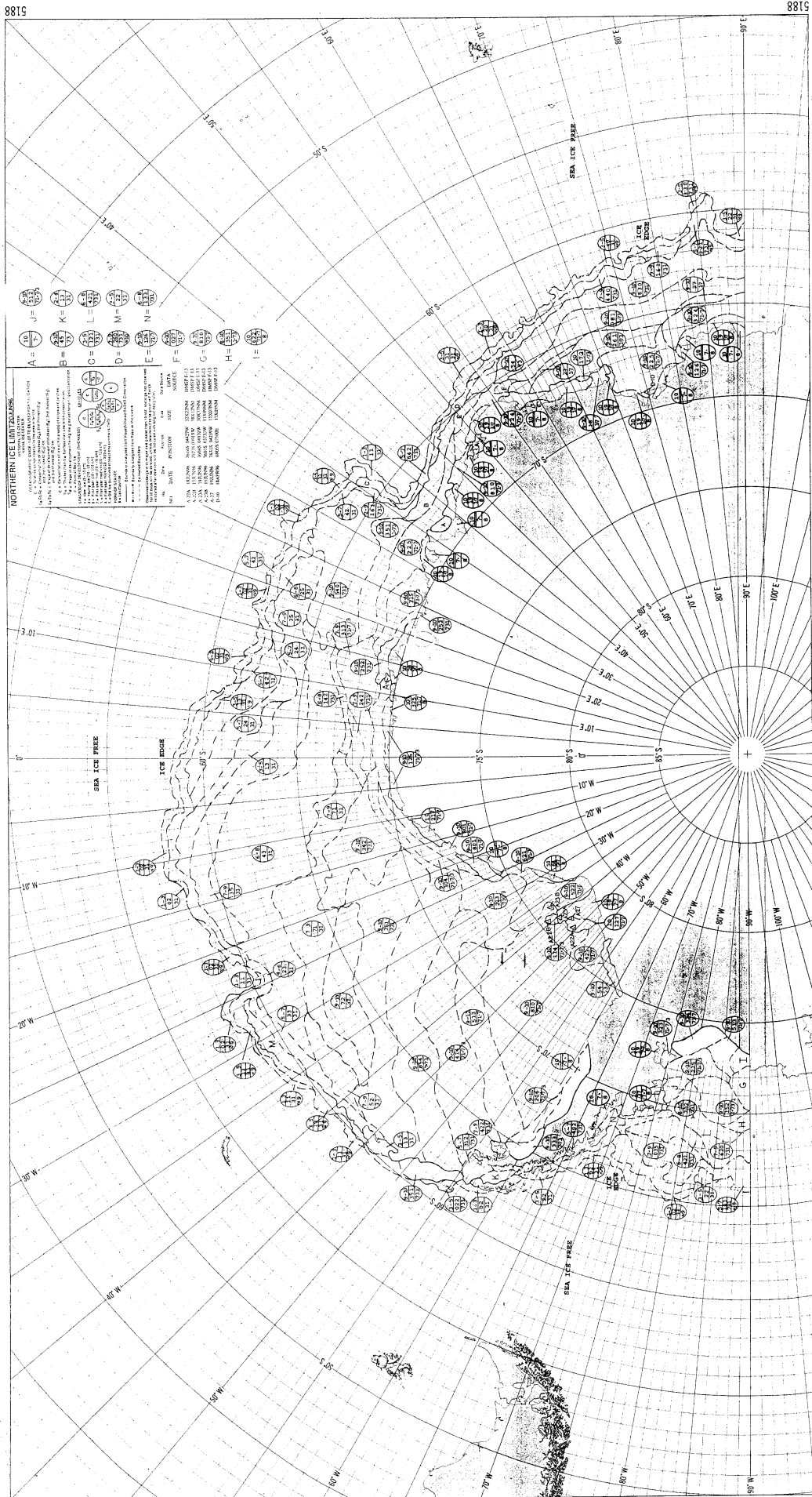
- a. The temperature of the air and water.
- b. The direction and force of the wind.
- c. The duration of the exposure to the elements.
- d. The nature of the surface.
- e. The amount of snow on the surface.
- f. The amount of ice already present.
- g. The amount of ice already melted.
- h. The amount of ice already frozen.
- i. The amount of ice already broken up.
- j. The amount of ice already compacted.
- k. The amount of ice already consolidated.
- l. The amount of ice already fused.
- m. The amount of ice already solidified.
- n. The amount of ice already hardened.
- o. The amount of ice already strengthened.
- p. The amount of ice already toughened.
- q. The amount of ice already toughened.
- r. The amount of ice already toughened.
- s. The amount of ice already toughened.
- t. The amount of ice already toughened.
- u. The amount of ice already toughened.
- v. The amount of ice already toughened.
- w. The amount of ice already toughened.
- x. The amount of ice already toughened.
- y. The amount of ice already toughened.
- z. The amount of ice already toughened.

2. The limit of sea ice is determined by the following factors:

- a. The temperature of the air and water.
- b. The direction and force of the wind.
- c. The duration of the exposure to the elements.
- d. The nature of the surface.
- e. The amount of snow on the surface.
- f. The amount of ice already present.
- g. The amount of ice already melted.
- h. The amount of ice already frozen.
- i. The amount of ice already broken up.
- j. The amount of ice already compacted.
- k. The amount of ice already consolidated.
- l. The amount of ice already fused.
- m. The amount of ice already solidified.
- n. The amount of ice already hardened.
- o. The amount of ice already strengthened.
- p. The amount of ice already toughened.
- q. The amount of ice already toughened.
- r. The amount of ice already toughened.
- s. The amount of ice already toughened.
- t. The amount of ice already toughened.
- u. The amount of ice already toughened.
- v. The amount of ice already toughened.
- w. The amount of ice already toughened.
- x. The amount of ice already toughened.
- y. The amount of ice already toughened.
- z. The amount of ice already toughened.

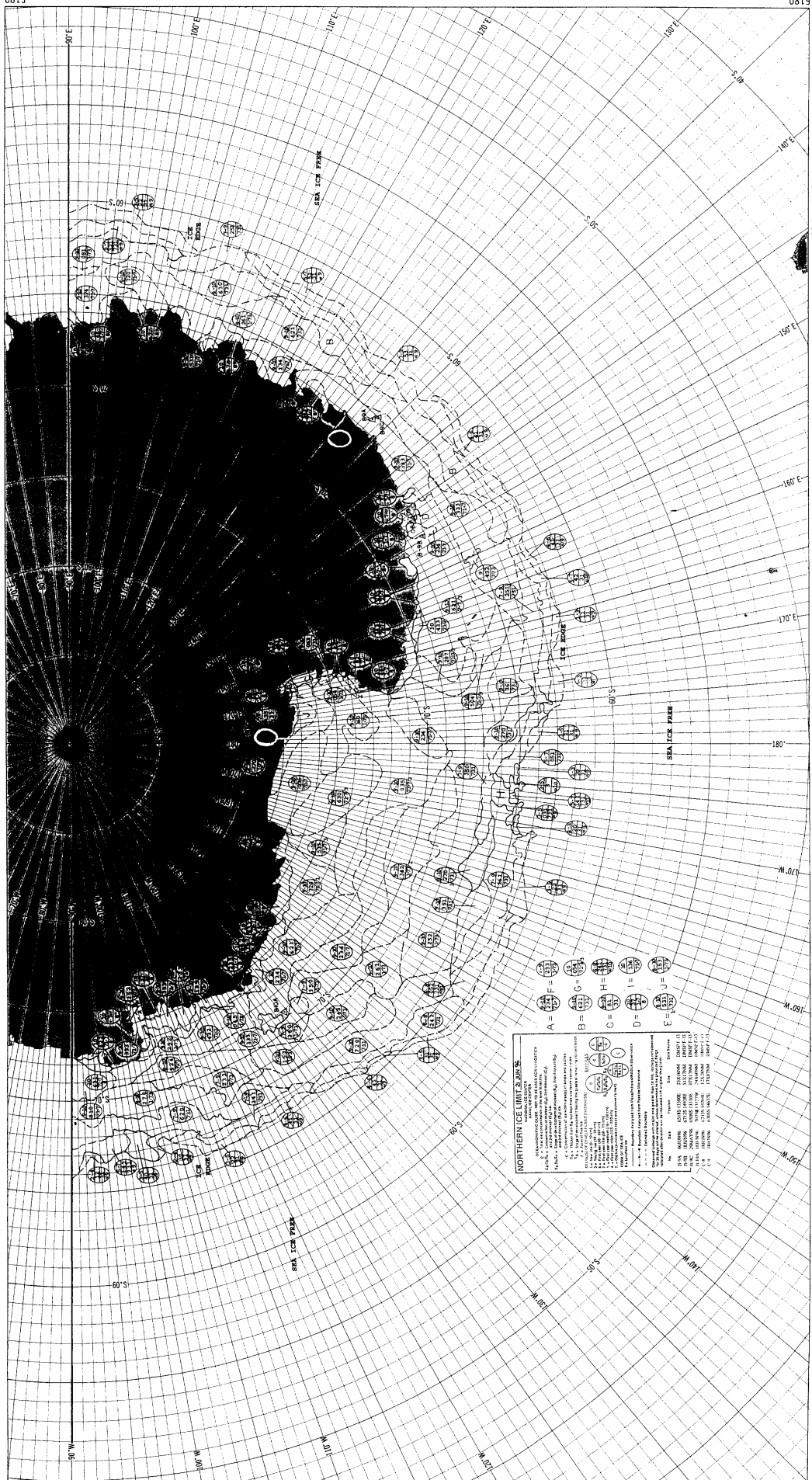




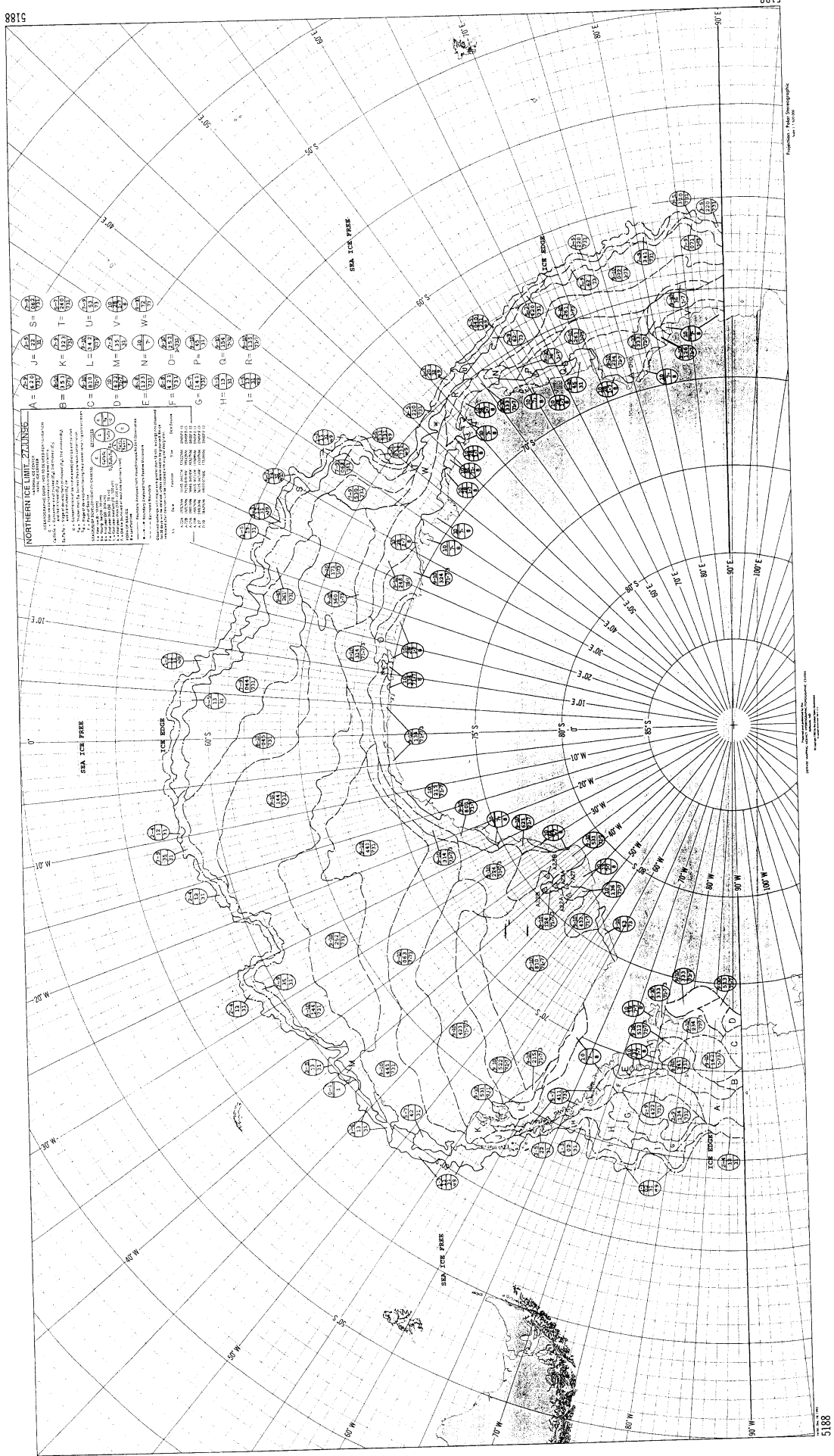


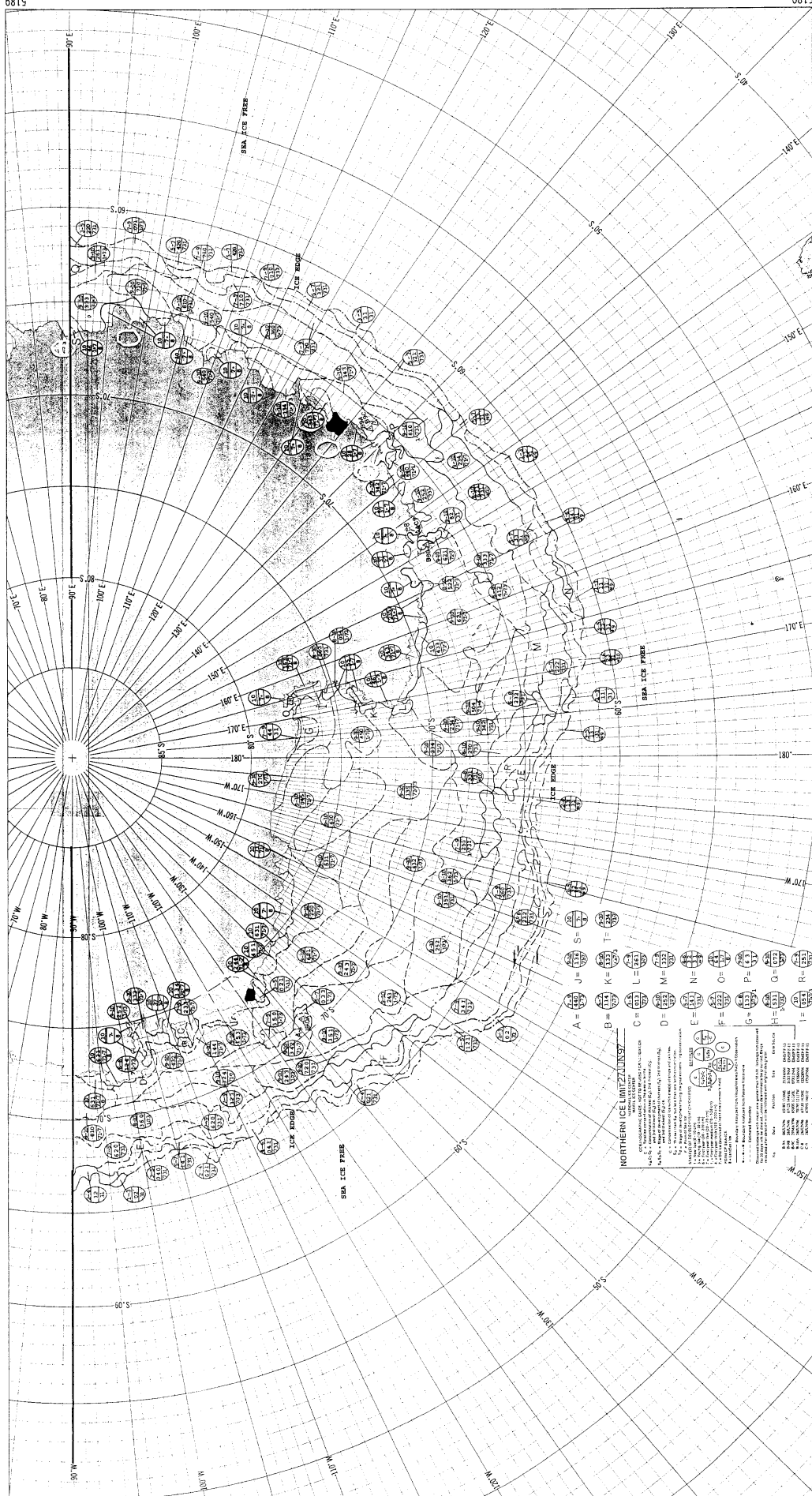
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Scale: 1:100,000

Source: U.S. Navy Hydrographic Office  
Date: 1960



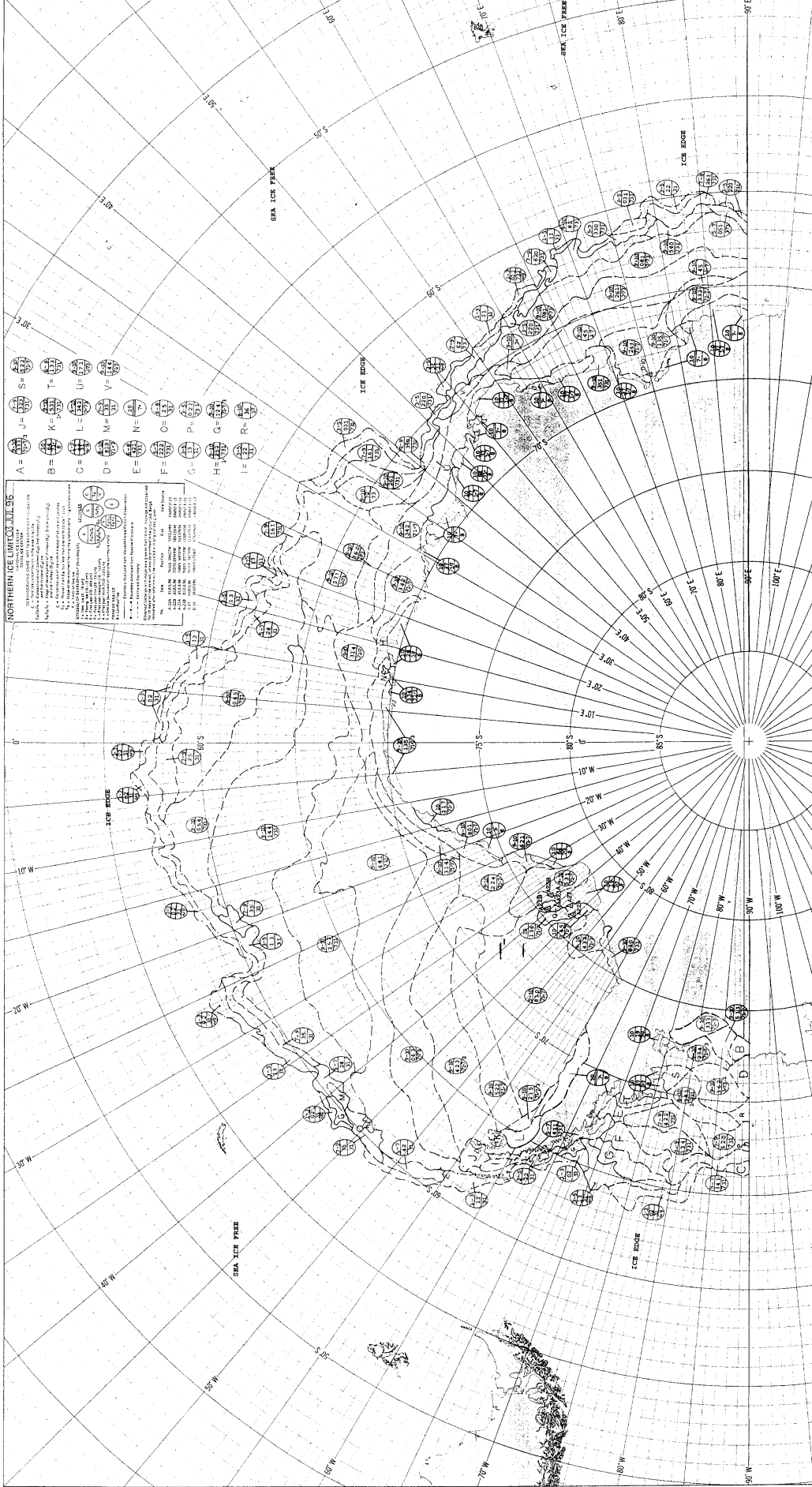






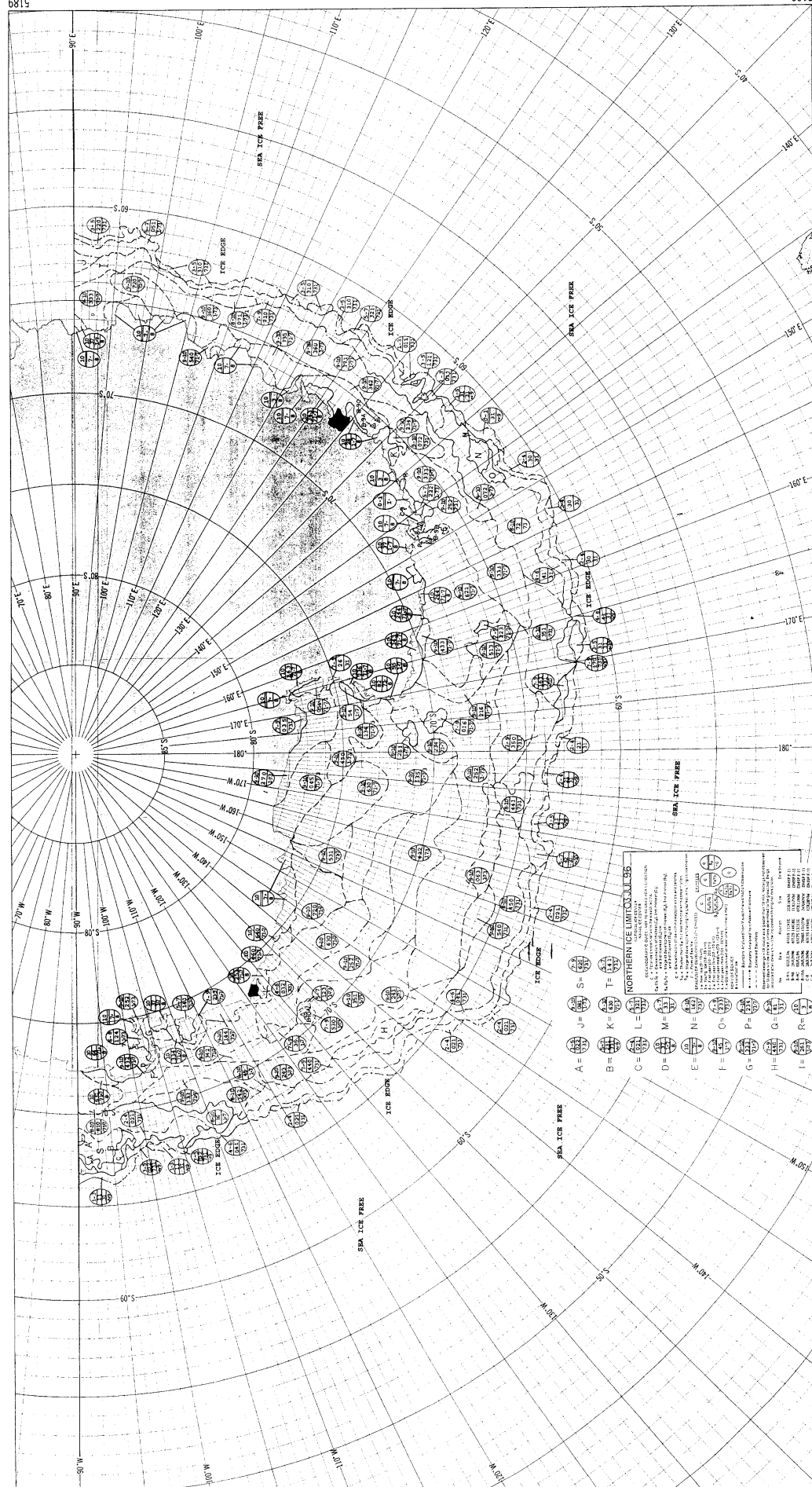
**NORTHERN ICE LIMITS**  
This chart shows the limits of sea ice in the Arctic region. The limits are based on the latest available information and are subject to change. The limits are shown in the following table:

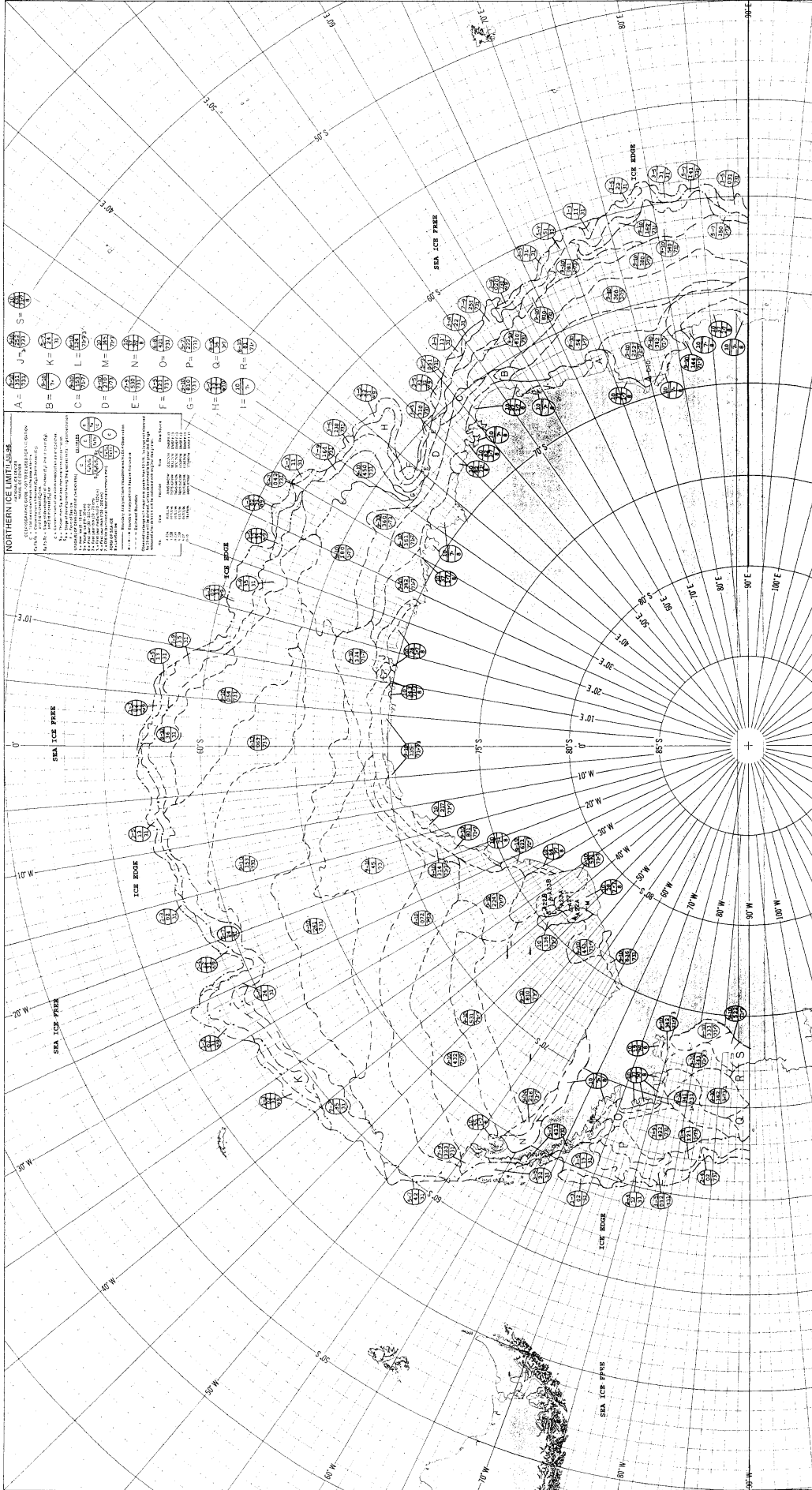
Letter	Number	Limit
A	1	60°N
B	2	65°N
C	3	70°N
D	4	75°N
E	5	80°N
F	6	85°N
G	7	90°N
H	8	90°N
I	9	90°N
J	10	90°N
K	11	90°N
L	12	90°N
M	13	90°N
N	14	90°N
O	15	90°N
P	16	90°N
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R	18	90°N
S	19	90°N
T	20	90°N



Projection: Polar Stereographic  
Scale: 1:100,000

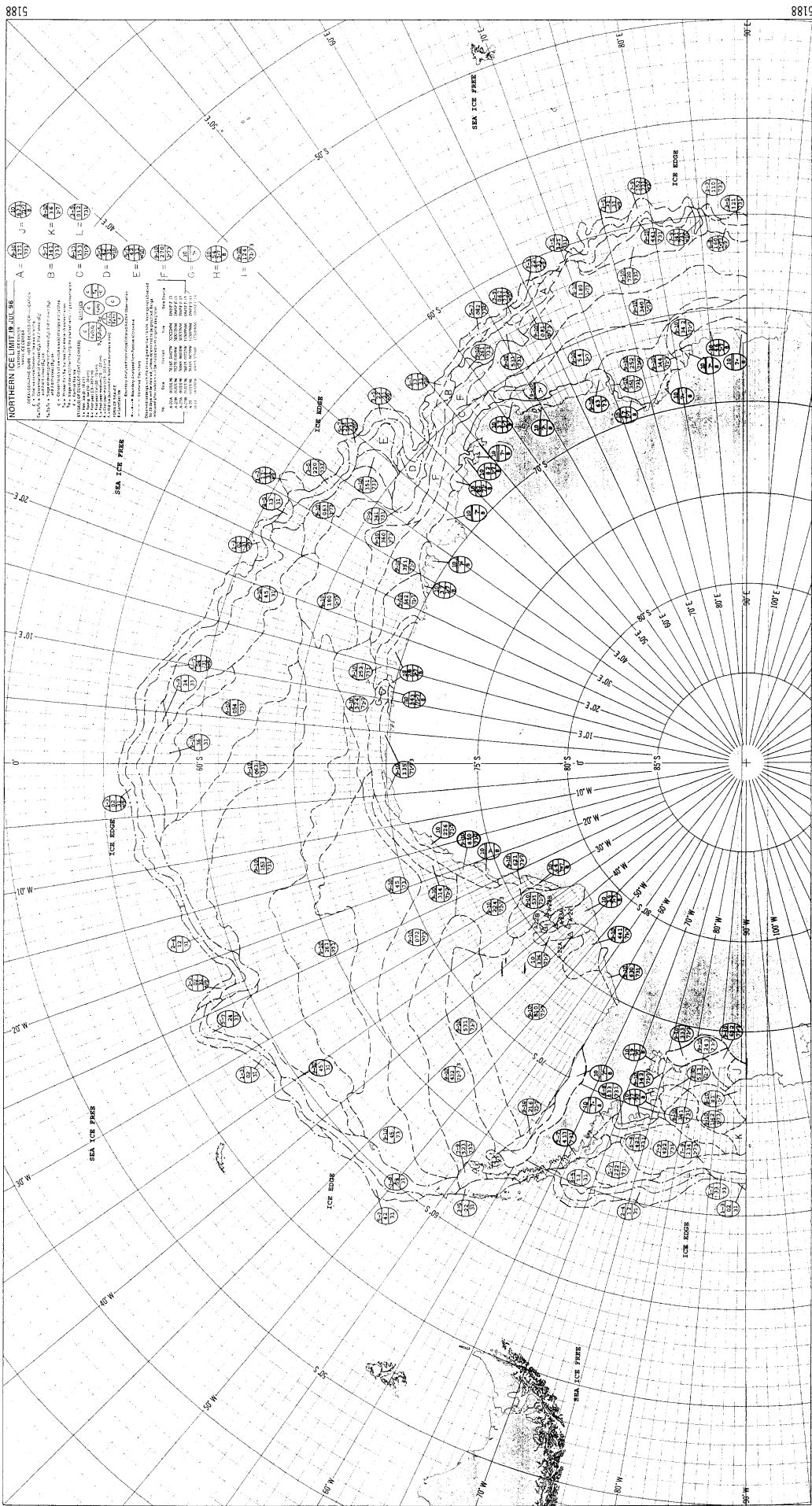
Source: National Oceanic and Atmospheric Administration  
Data: 1995



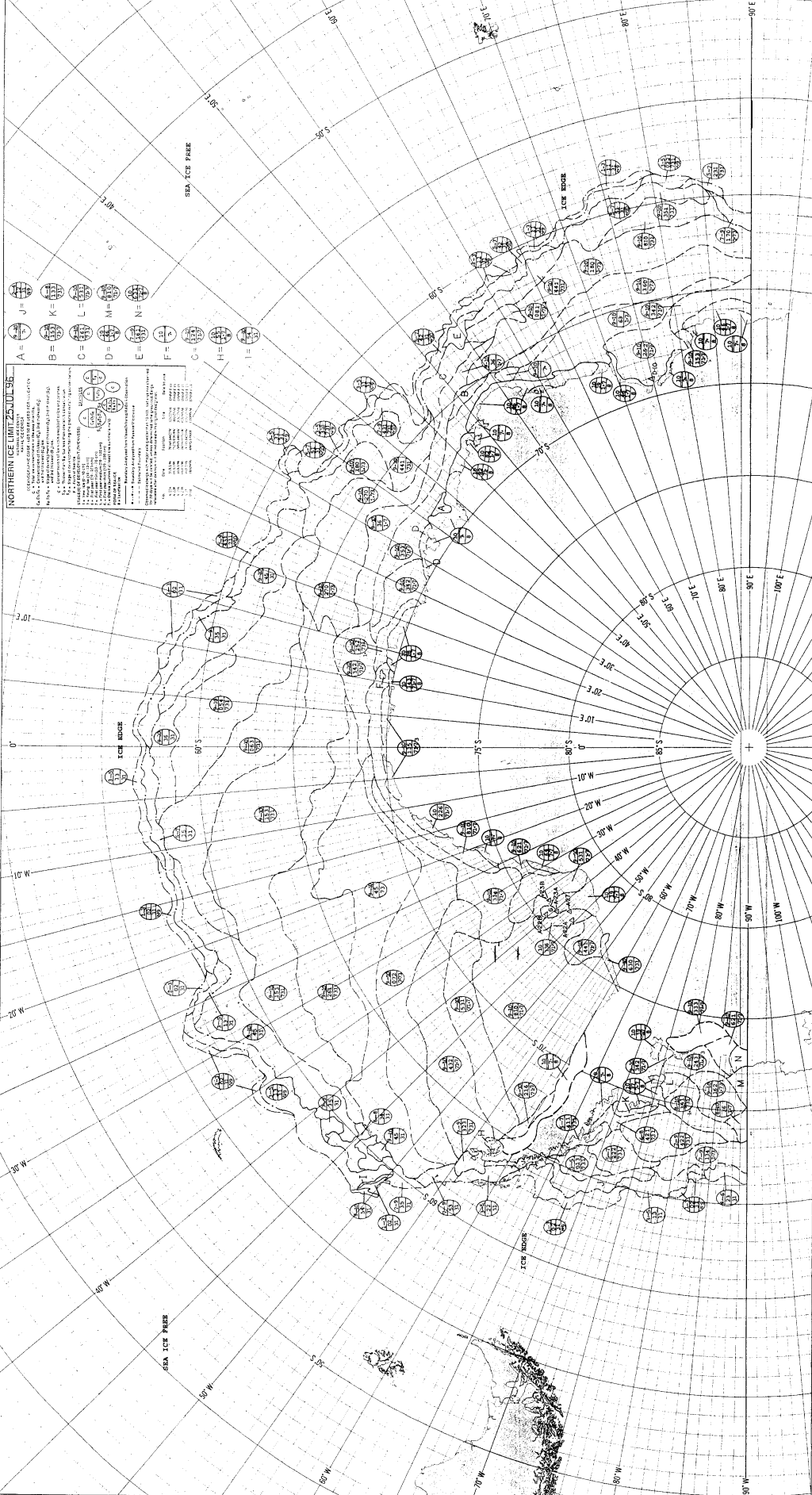


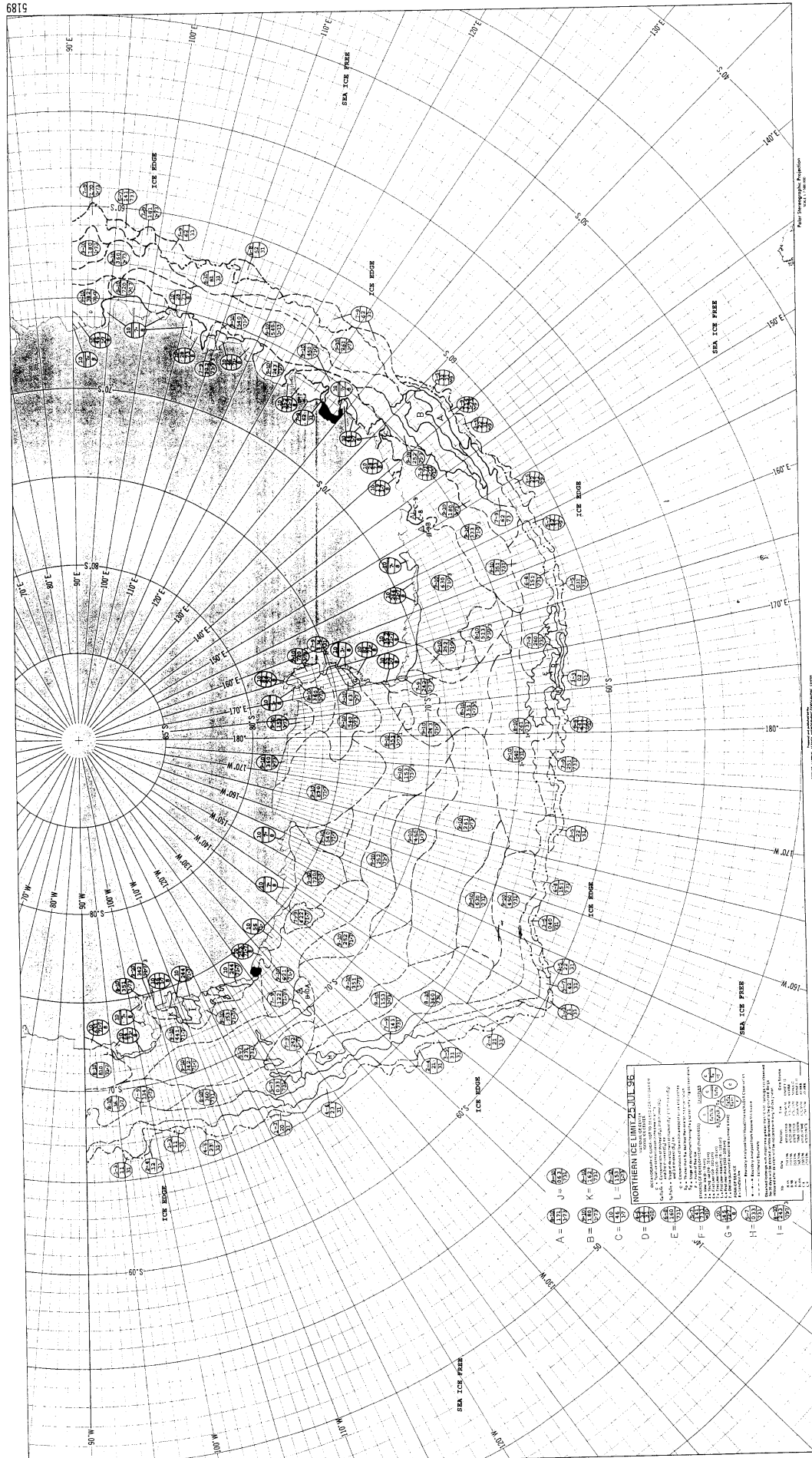


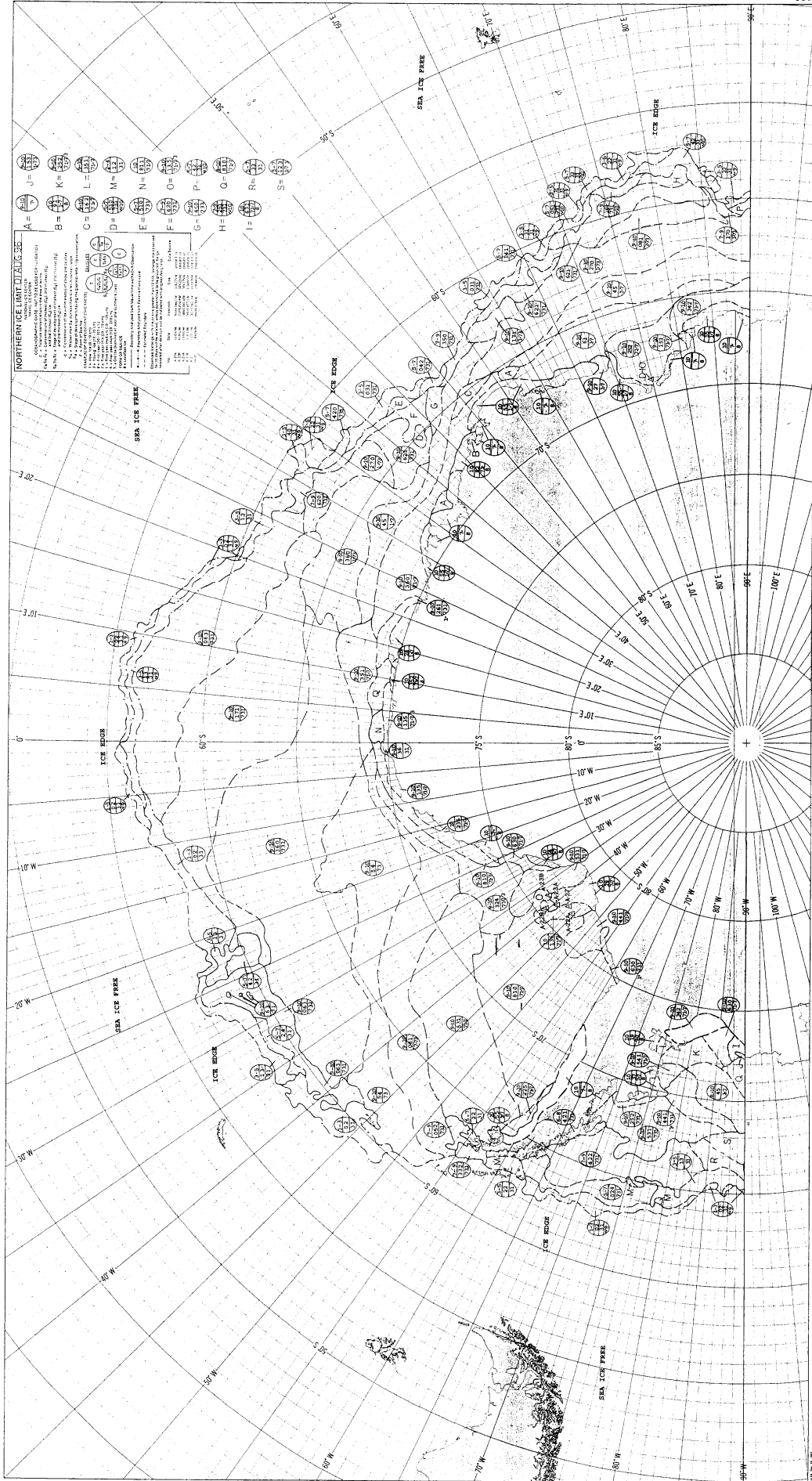


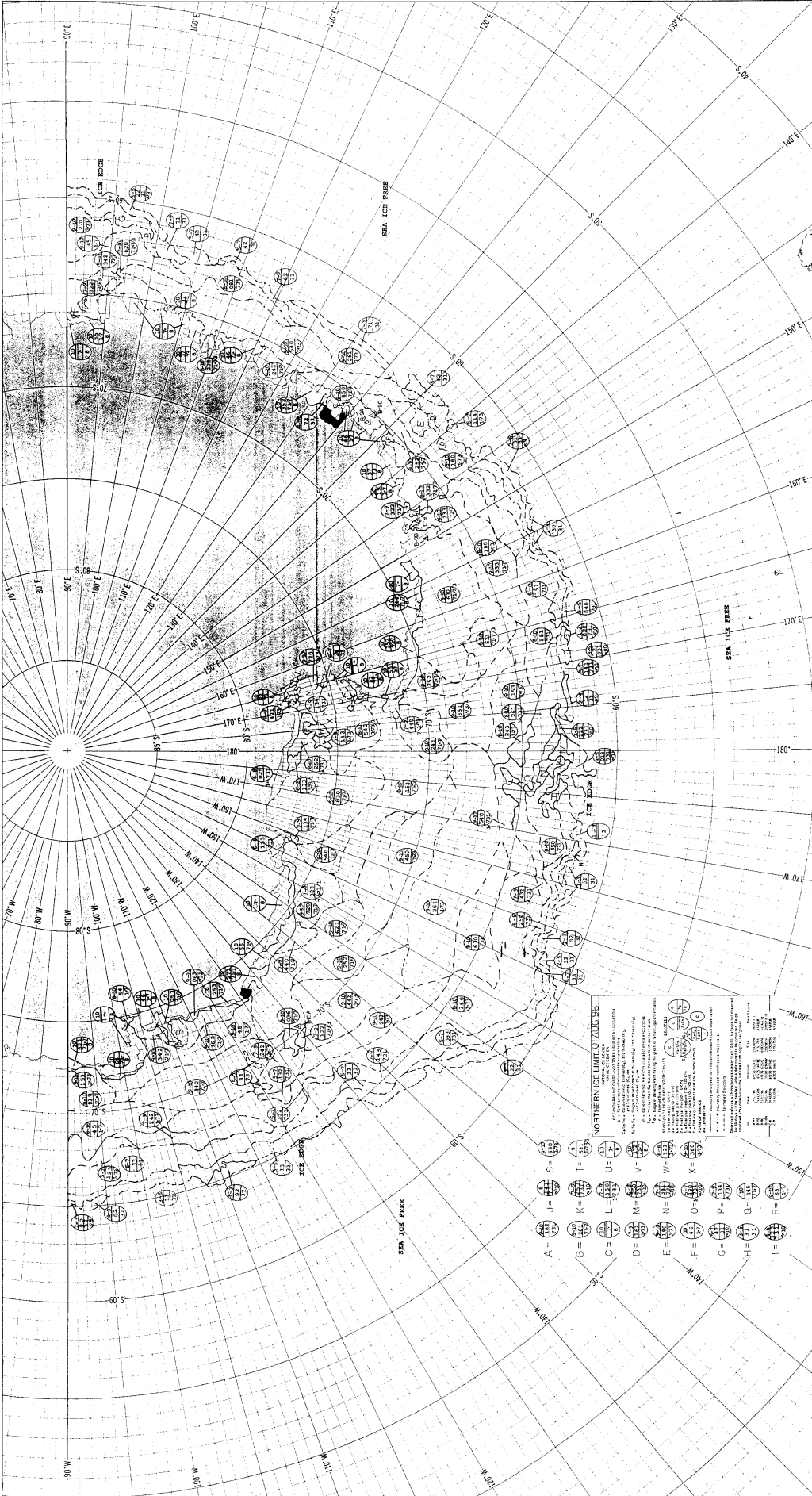




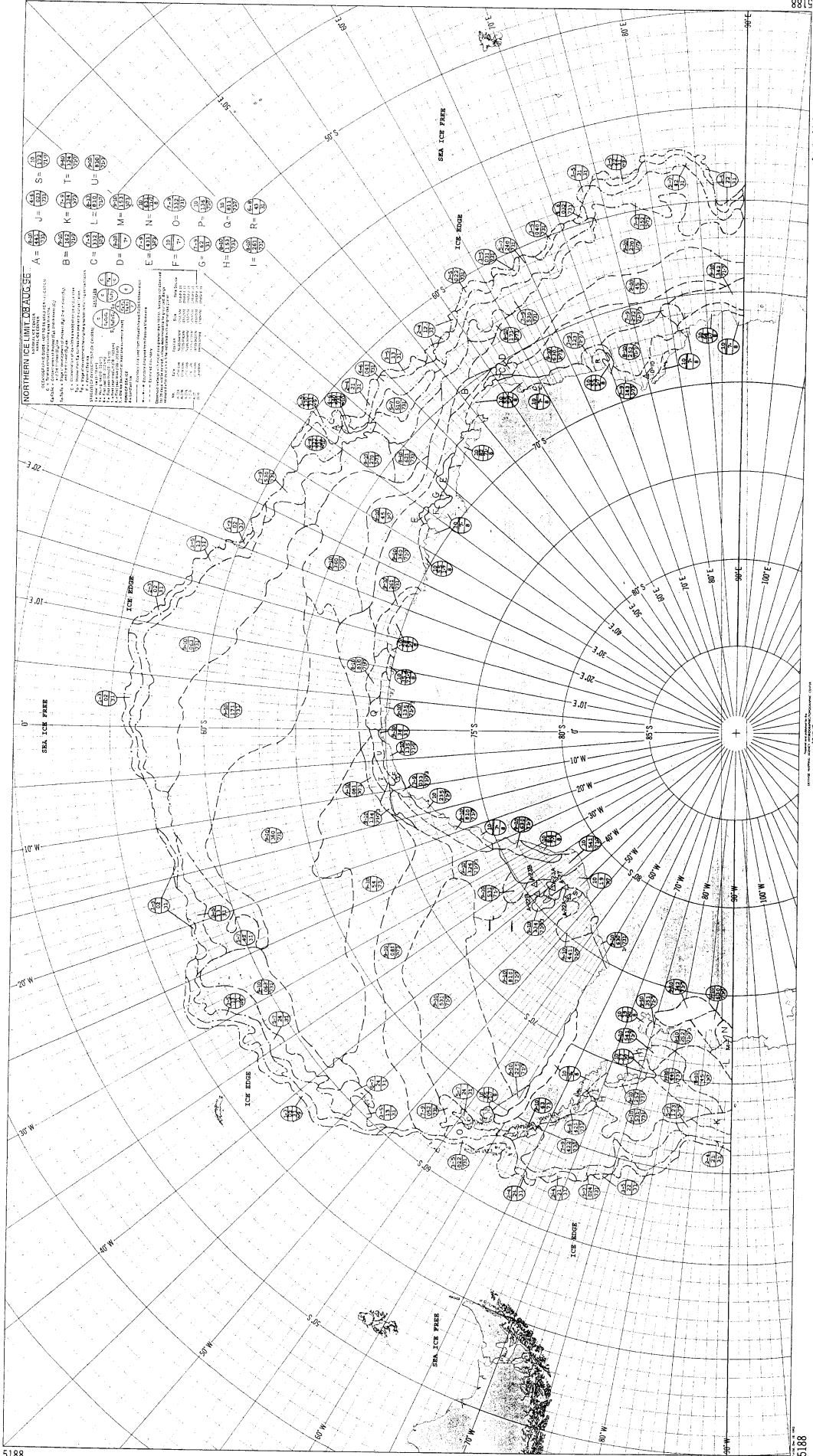


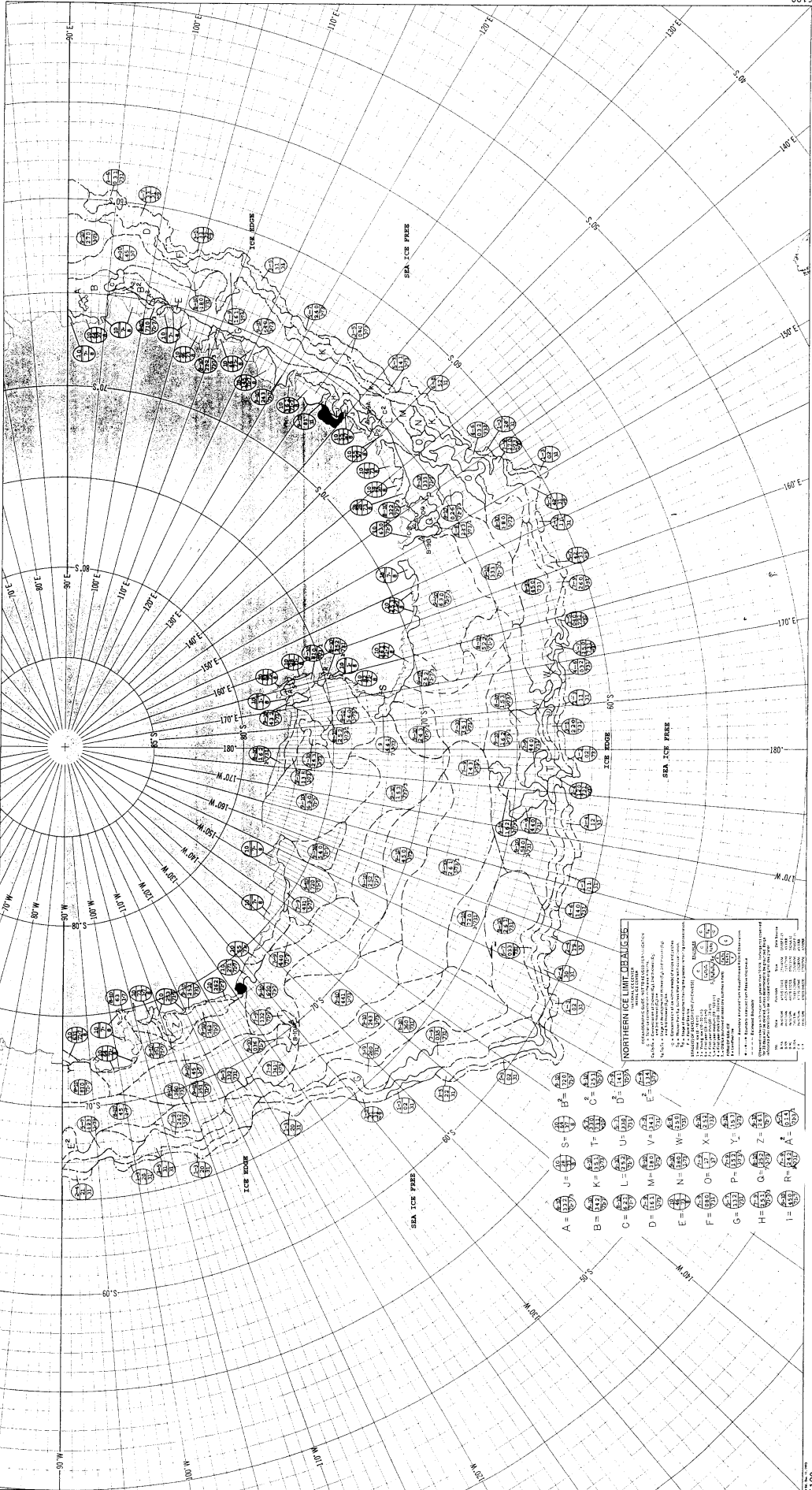






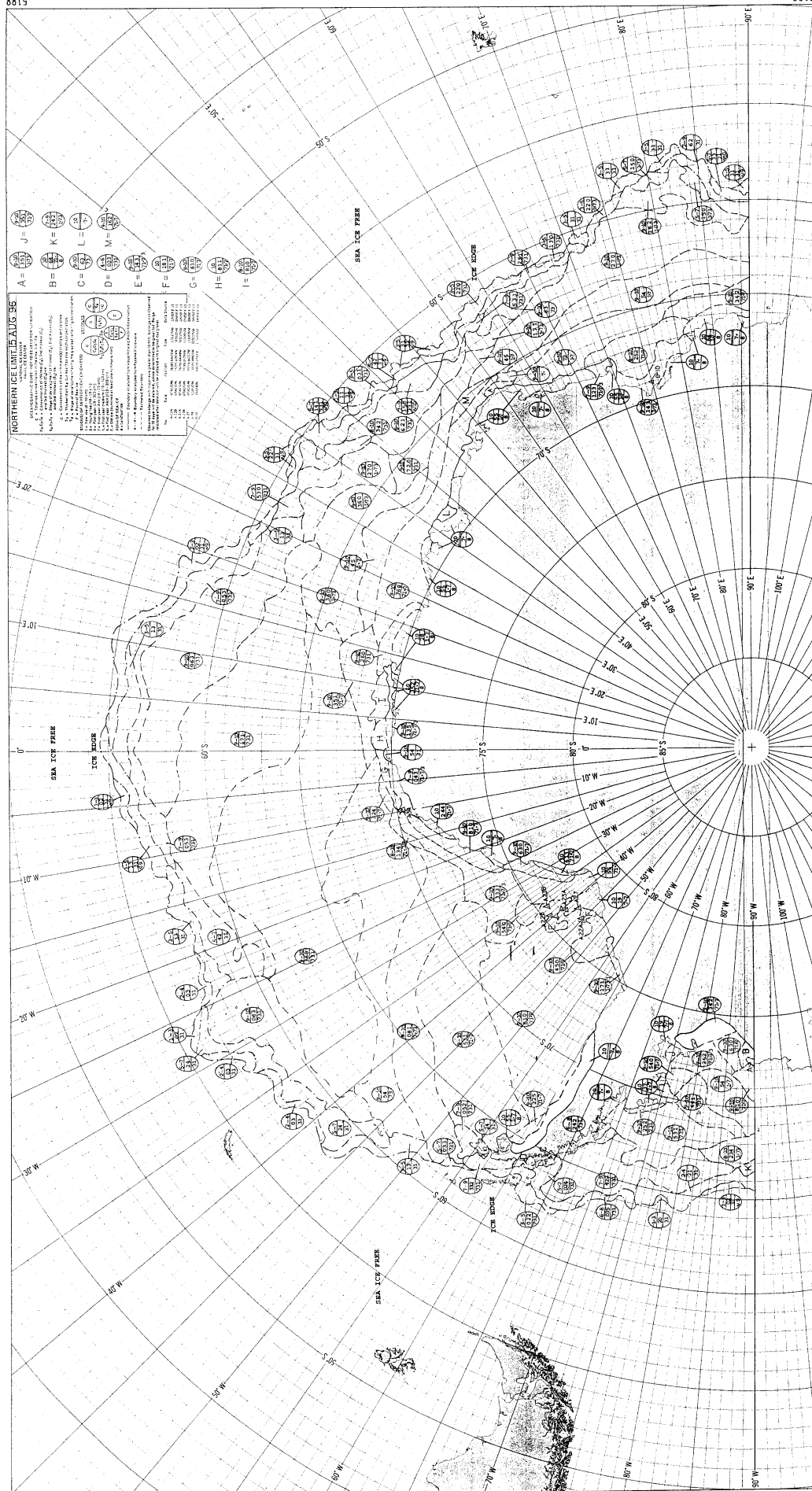


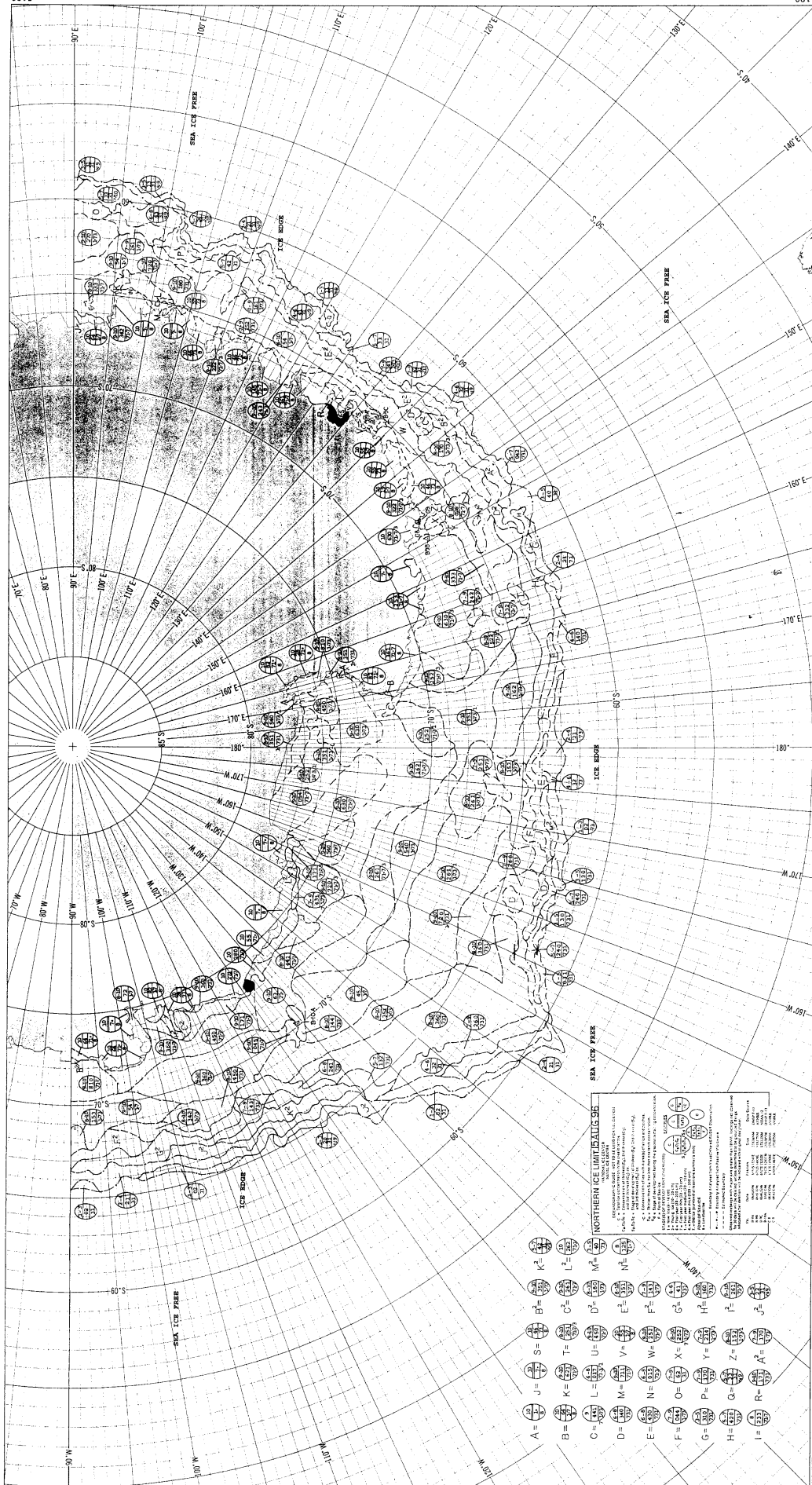


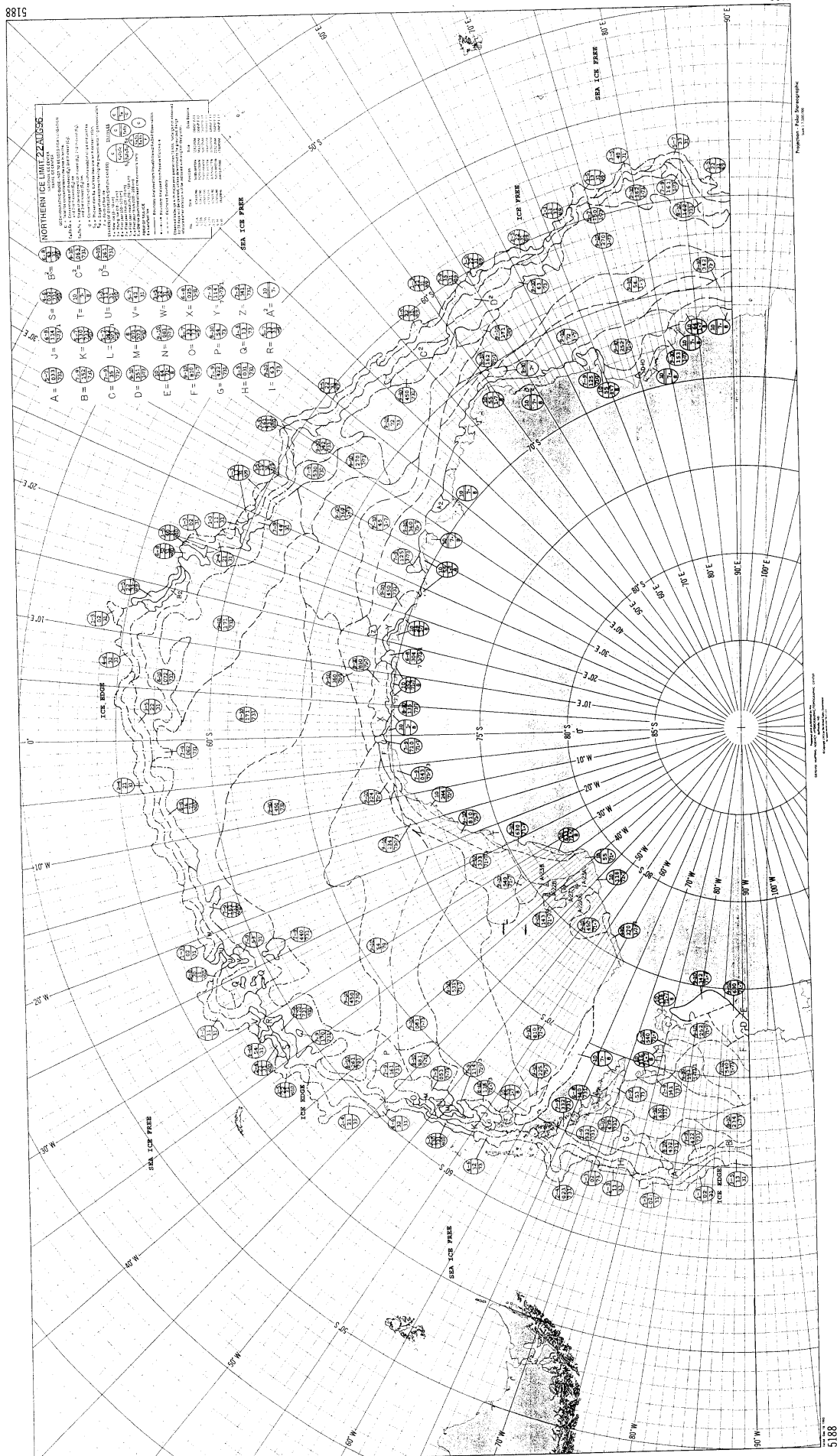


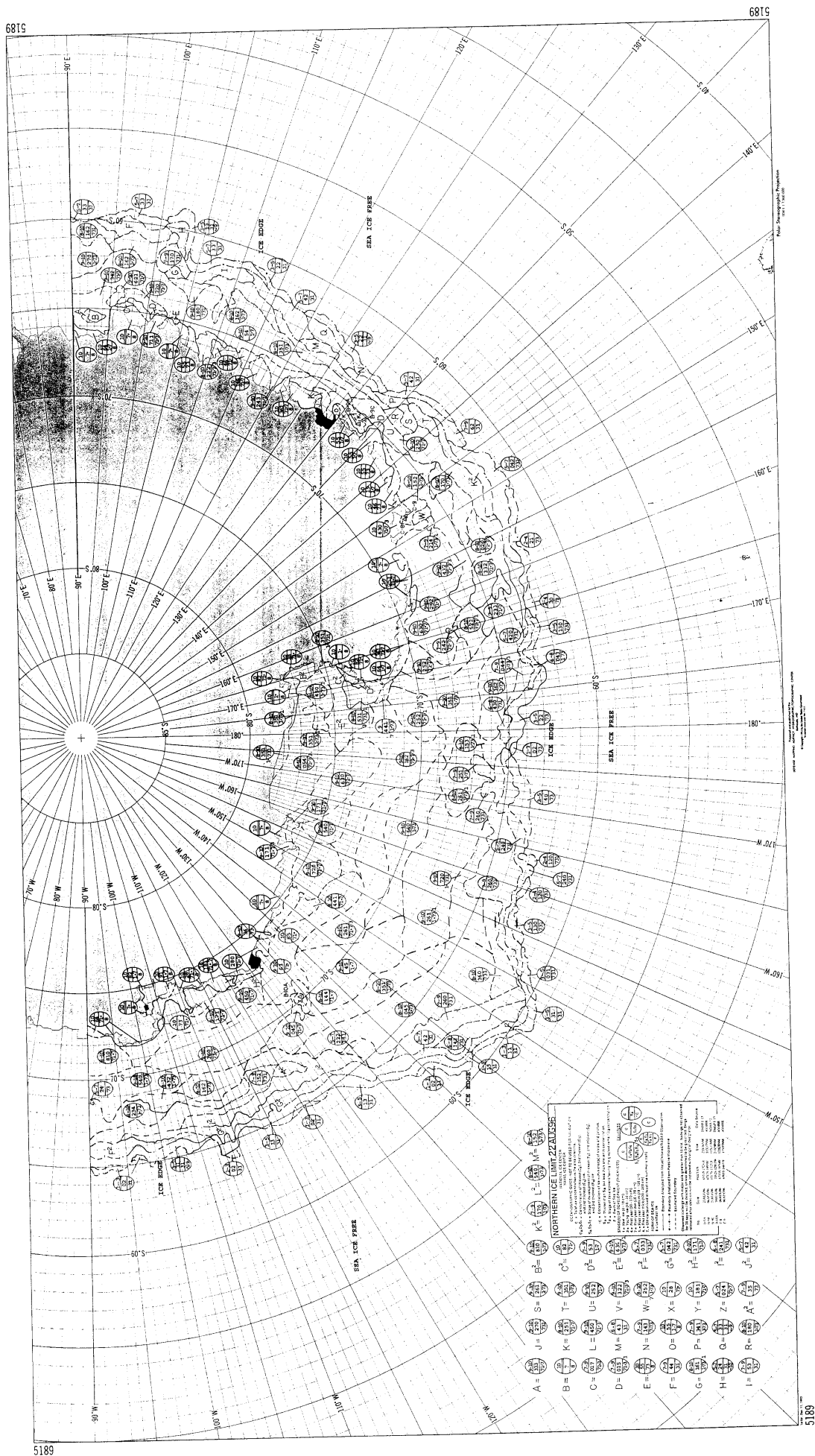
**NORTHERN DE LIMIT ORANGE**  
This chart is a reproduction of the original chart published by the Hydrographic Office, Washington, D.C., in 1911. It is a nautical chart of the Arctic region, showing the Arctic Ocean and surrounding landmasses. The chart features a grid of latitude and longitude lines, with latitude marked from 60°N to 90°N and longitude from 0° to 360° (labeled as 0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330, 360). The map includes numerous icebergs, represented by circular symbols with numbers inside, and various navigational markers. Key geographical features labeled include 'SEA ICE FREE' and 'ICE BOUND'. A compass rose is located in the upper left quadrant. A legend titled 'NORTHERN DE LIMIT ORANGE' is positioned in the lower right, providing information on ice conditions and navigational hazards. The chart is oriented with North at the top.

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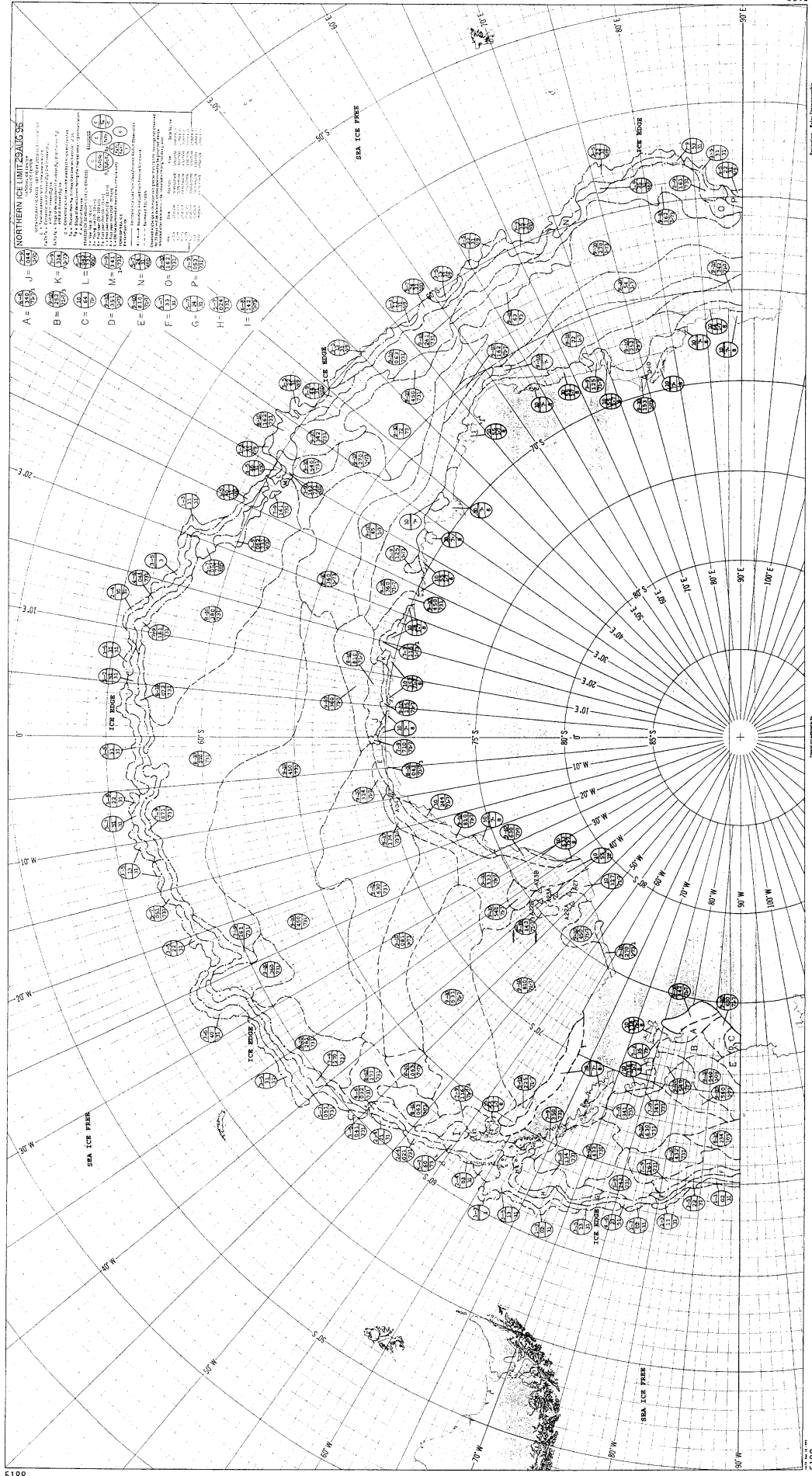








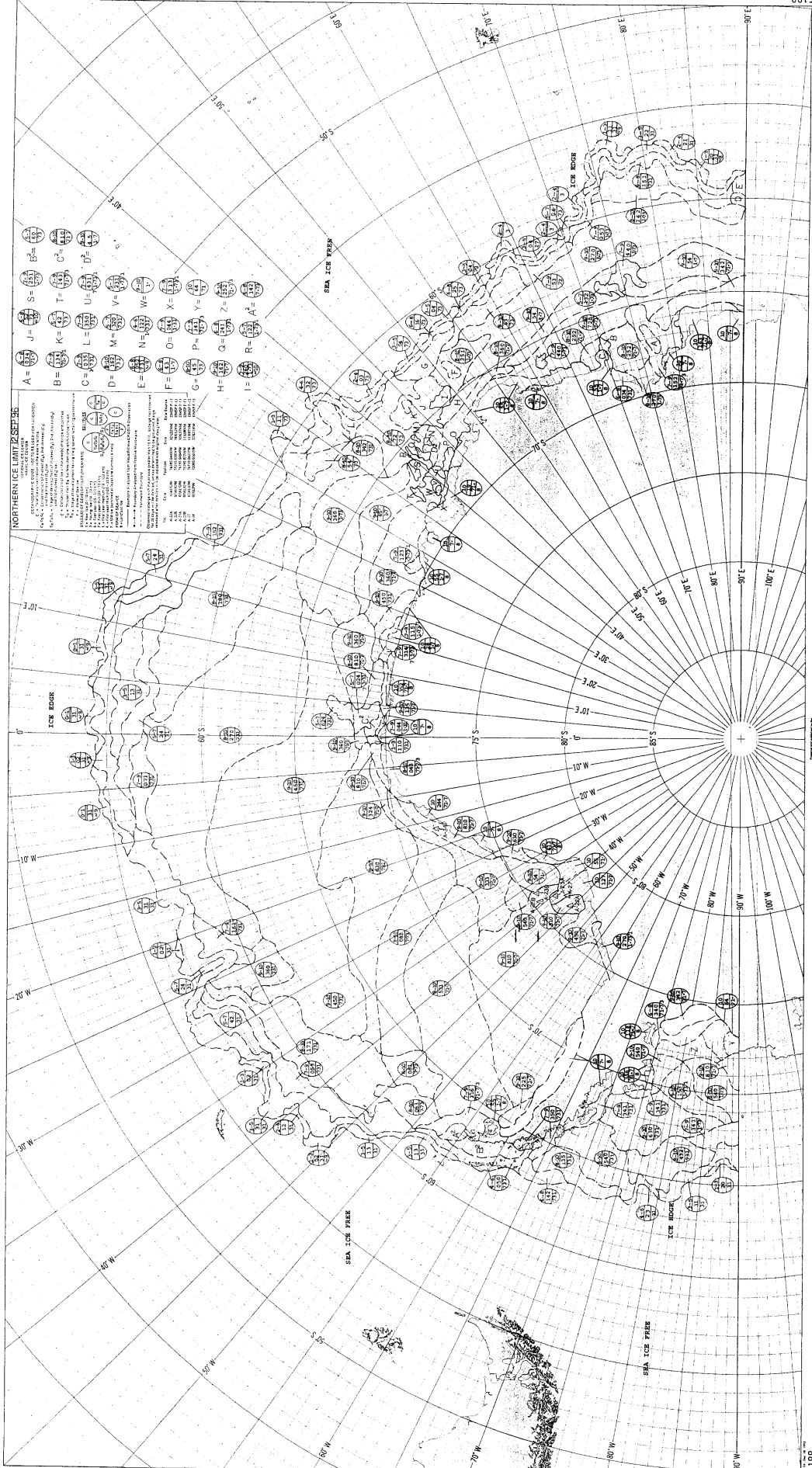


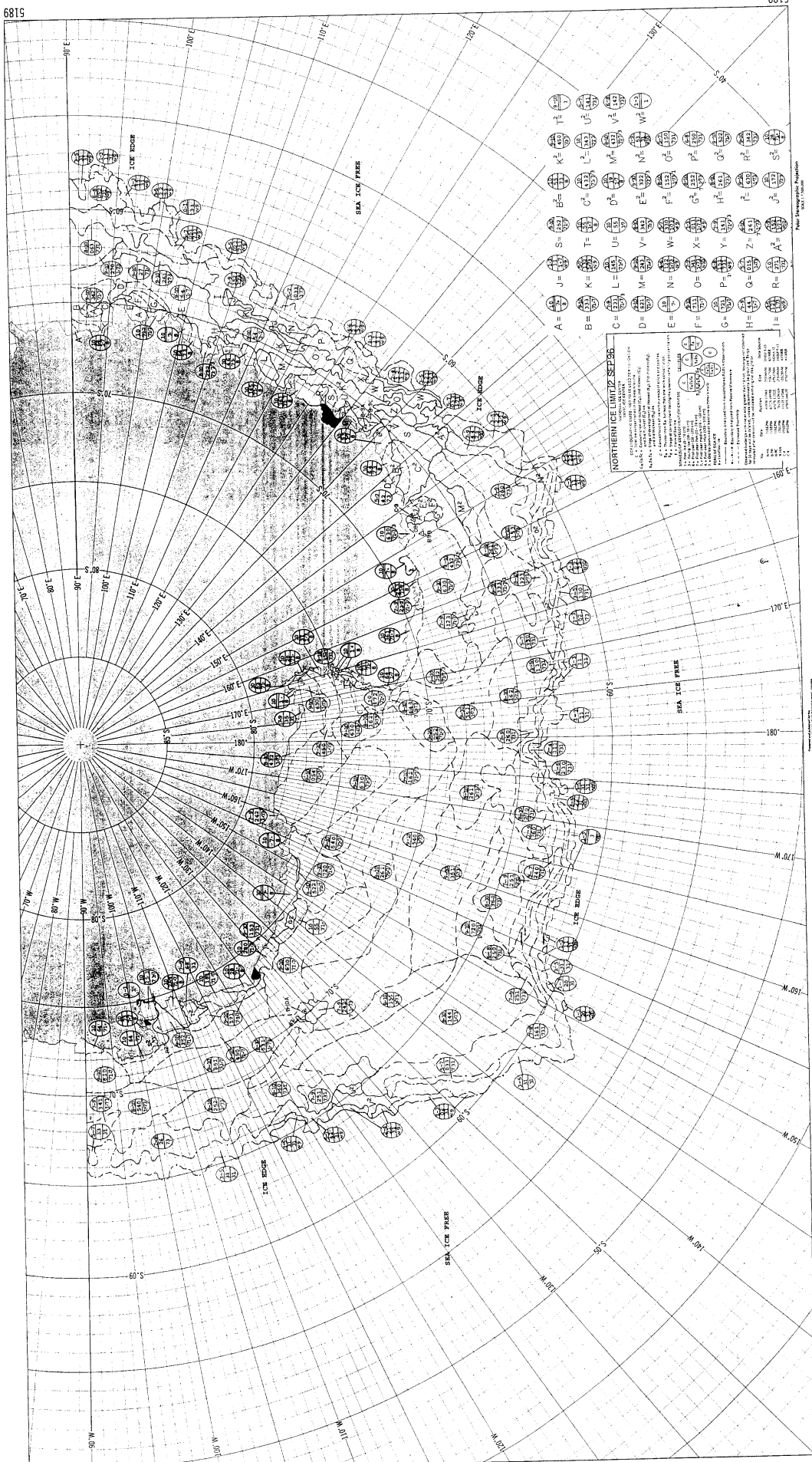






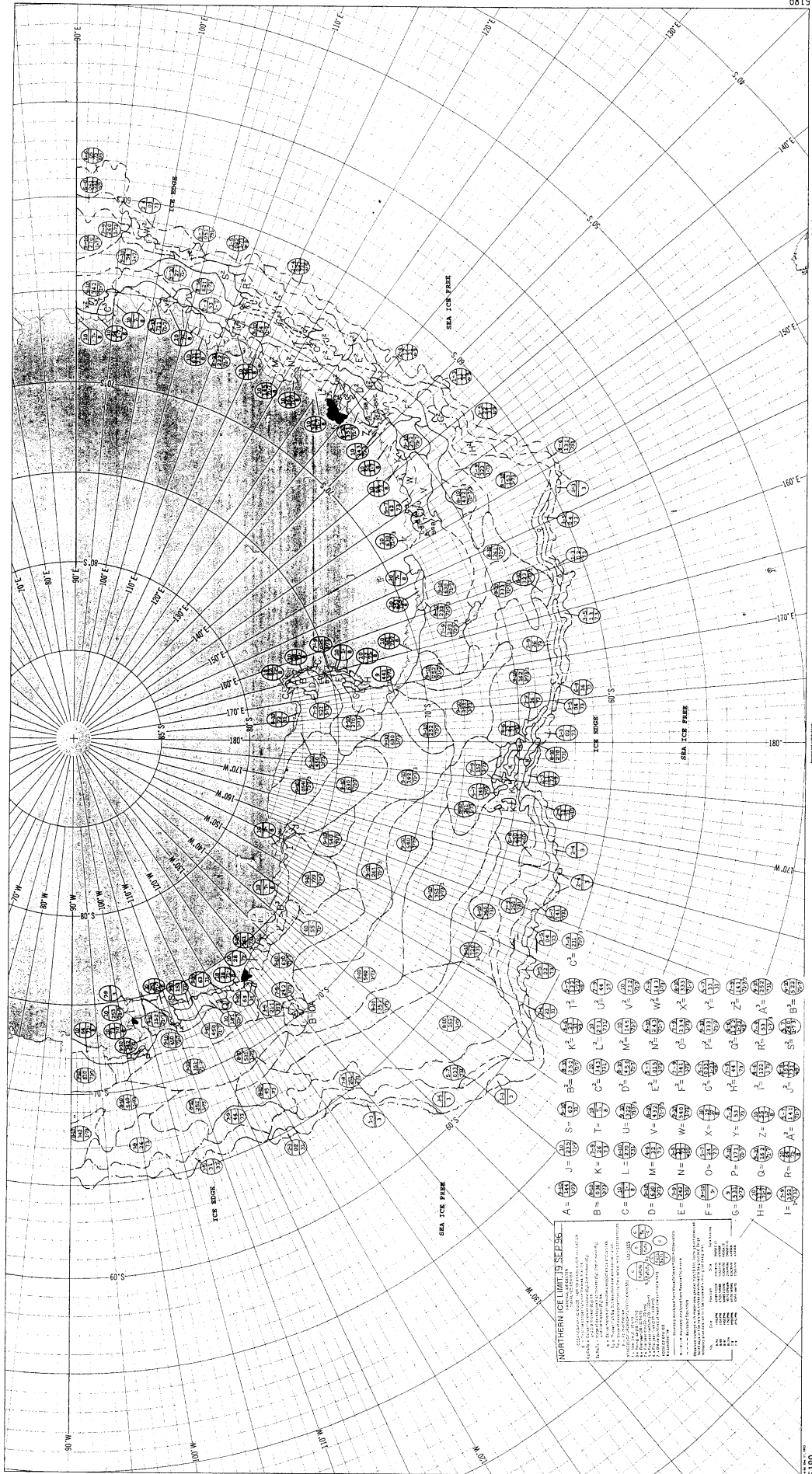


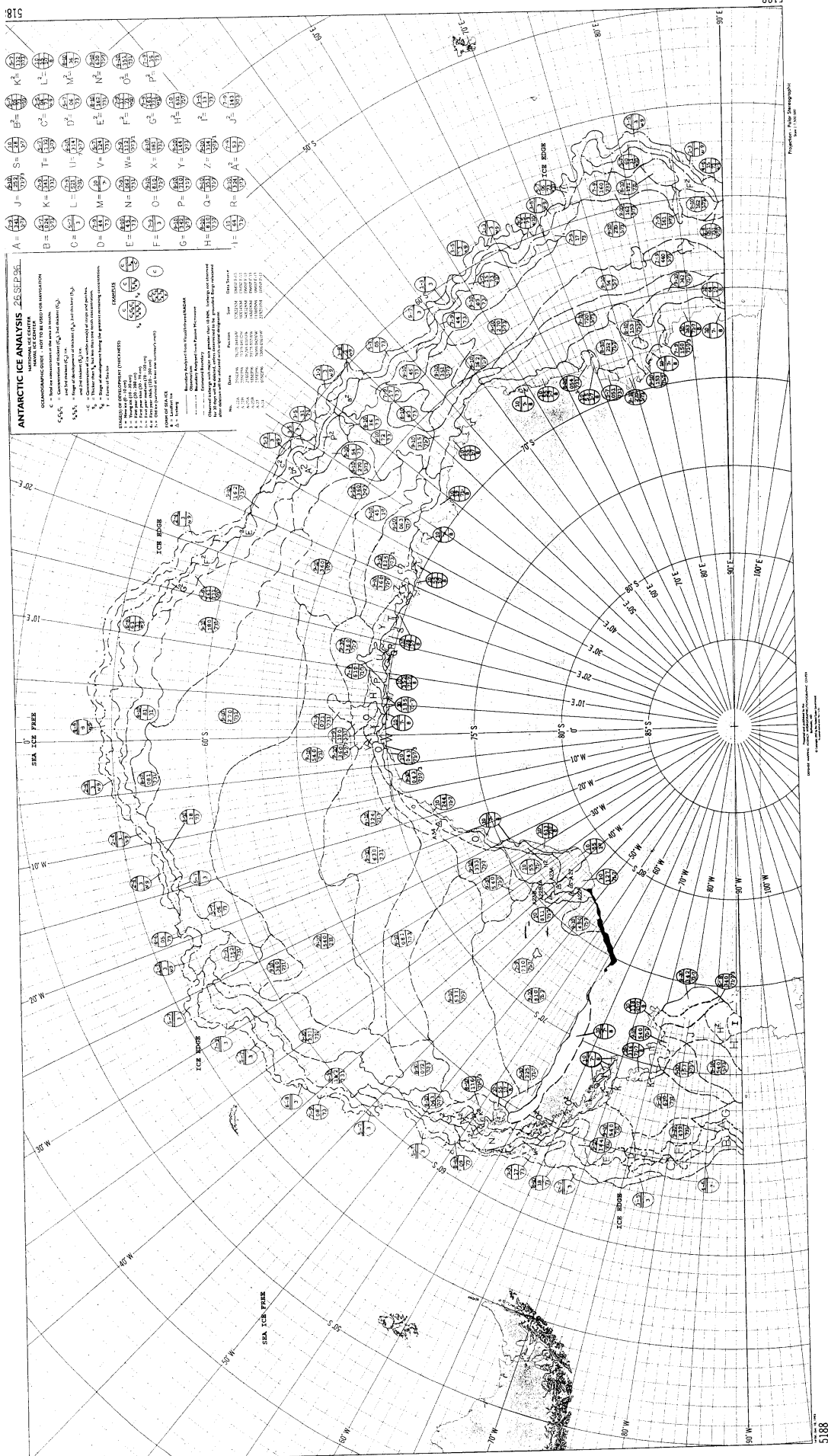


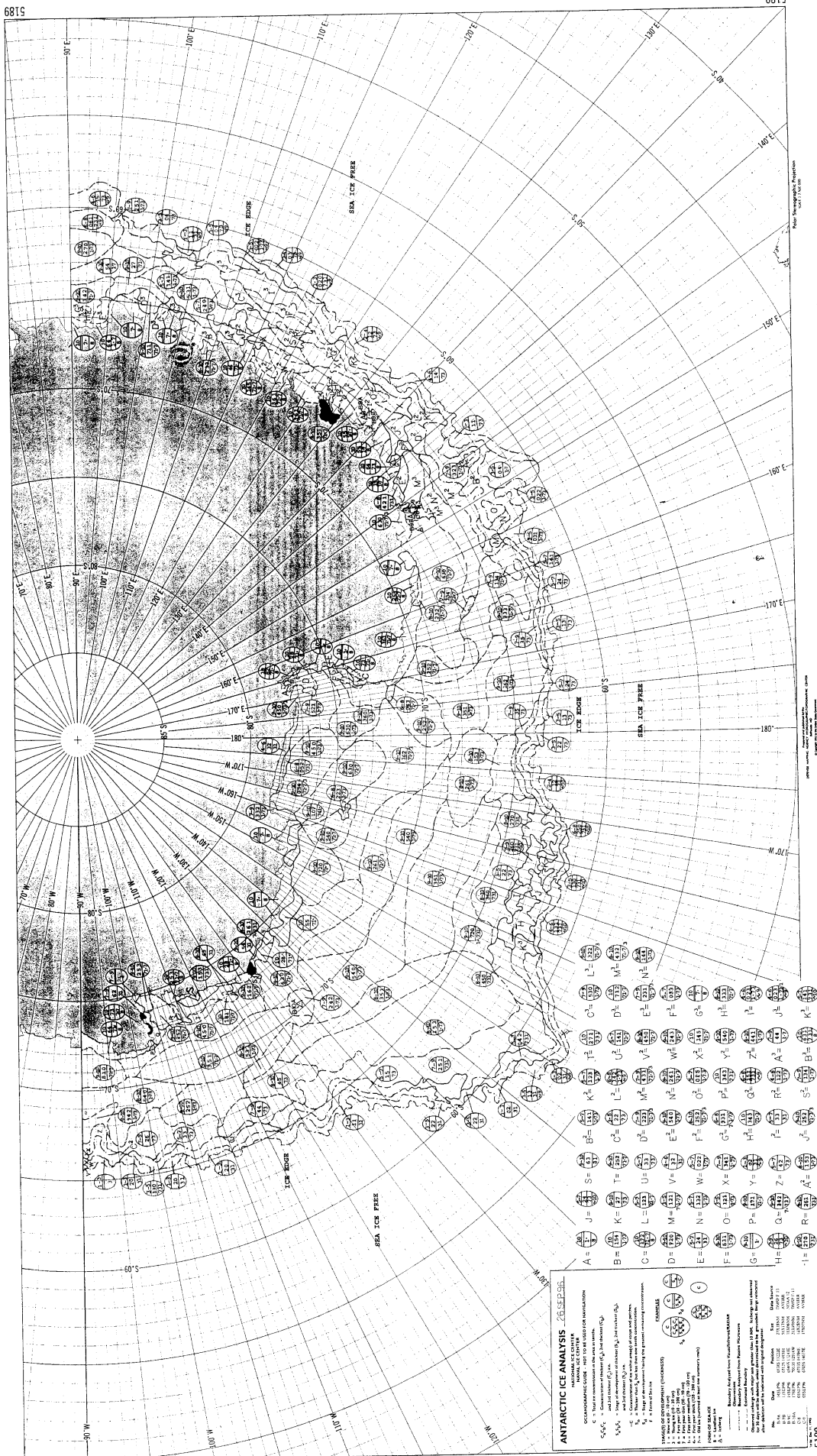


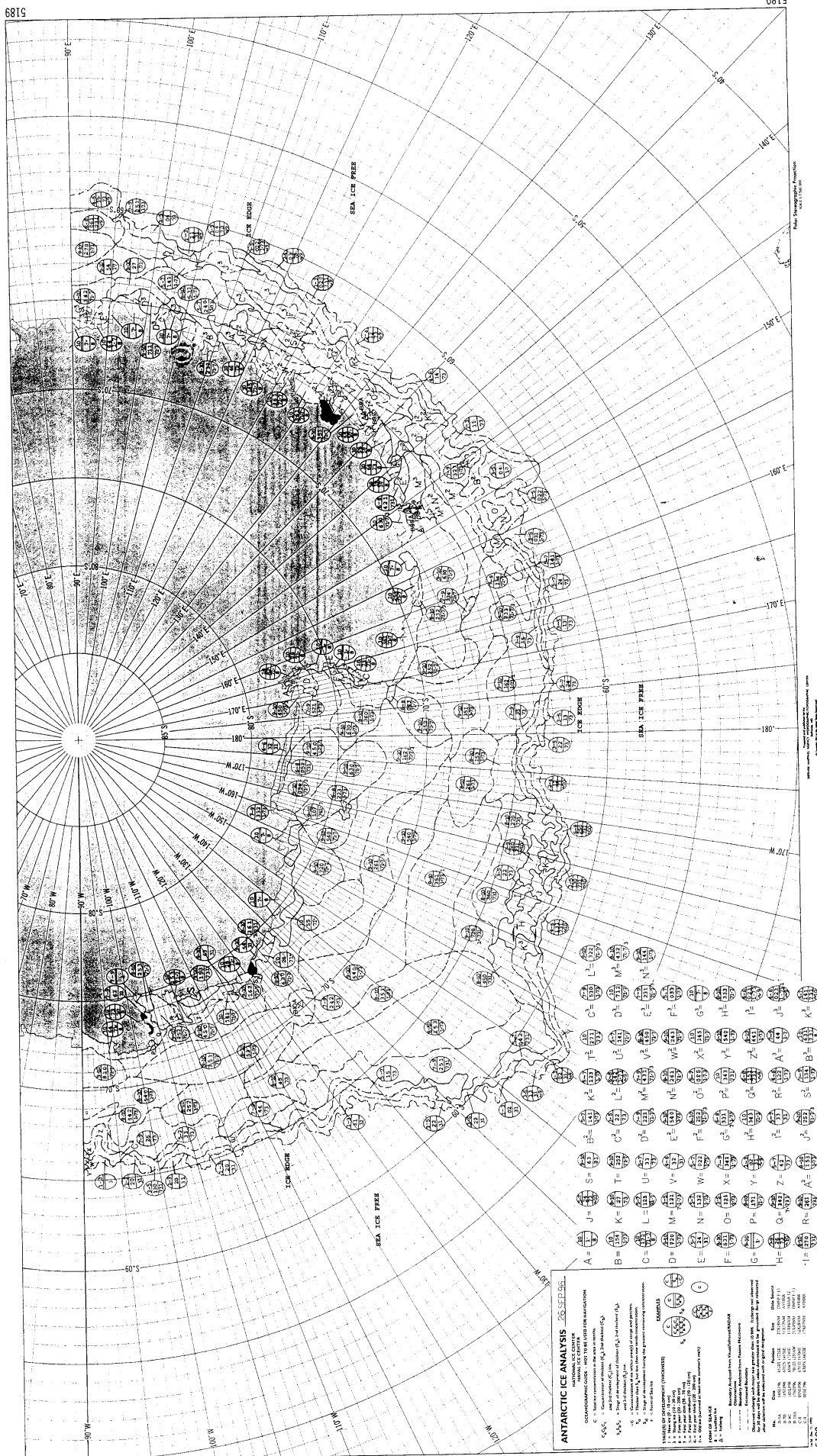








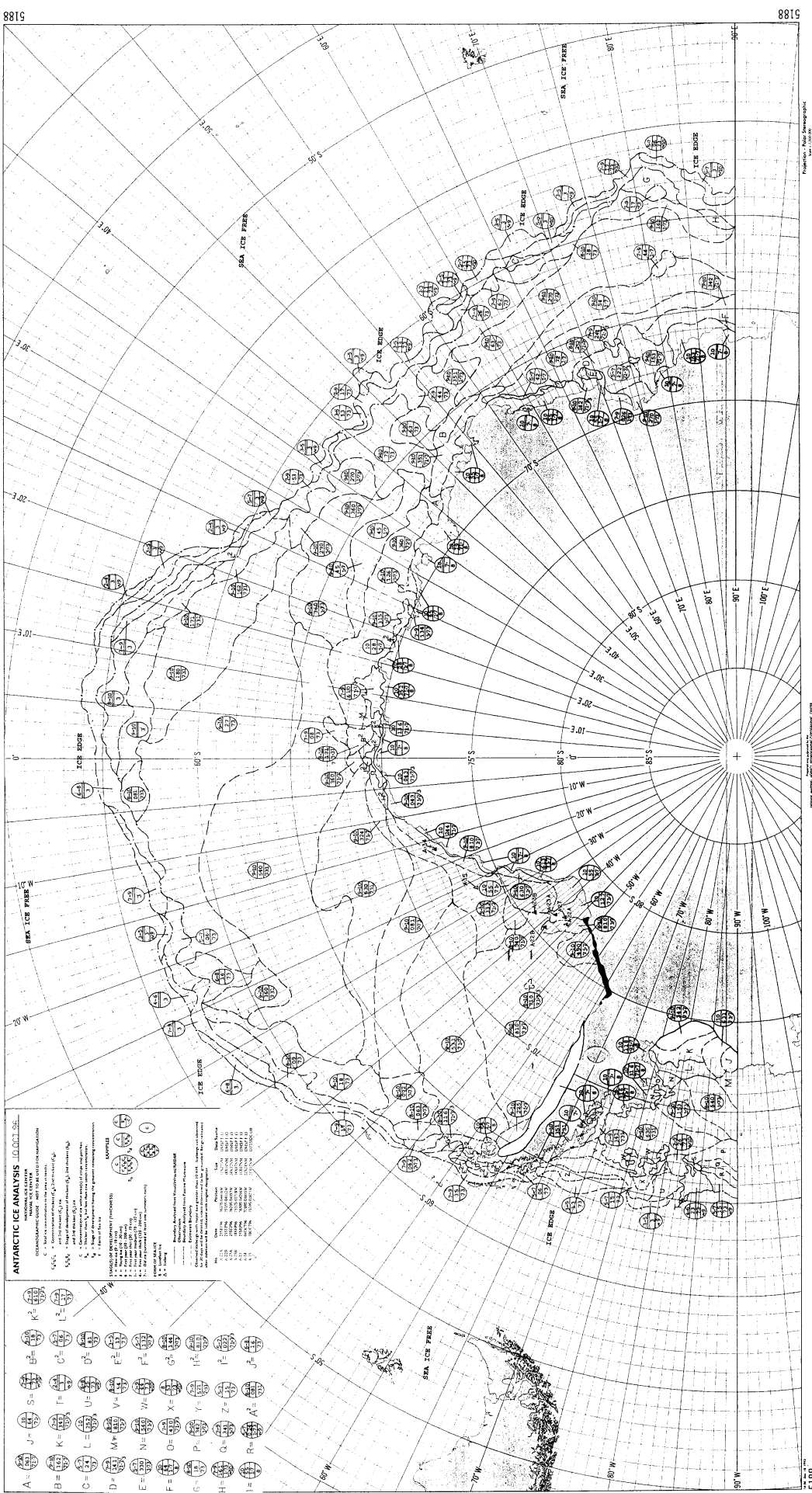




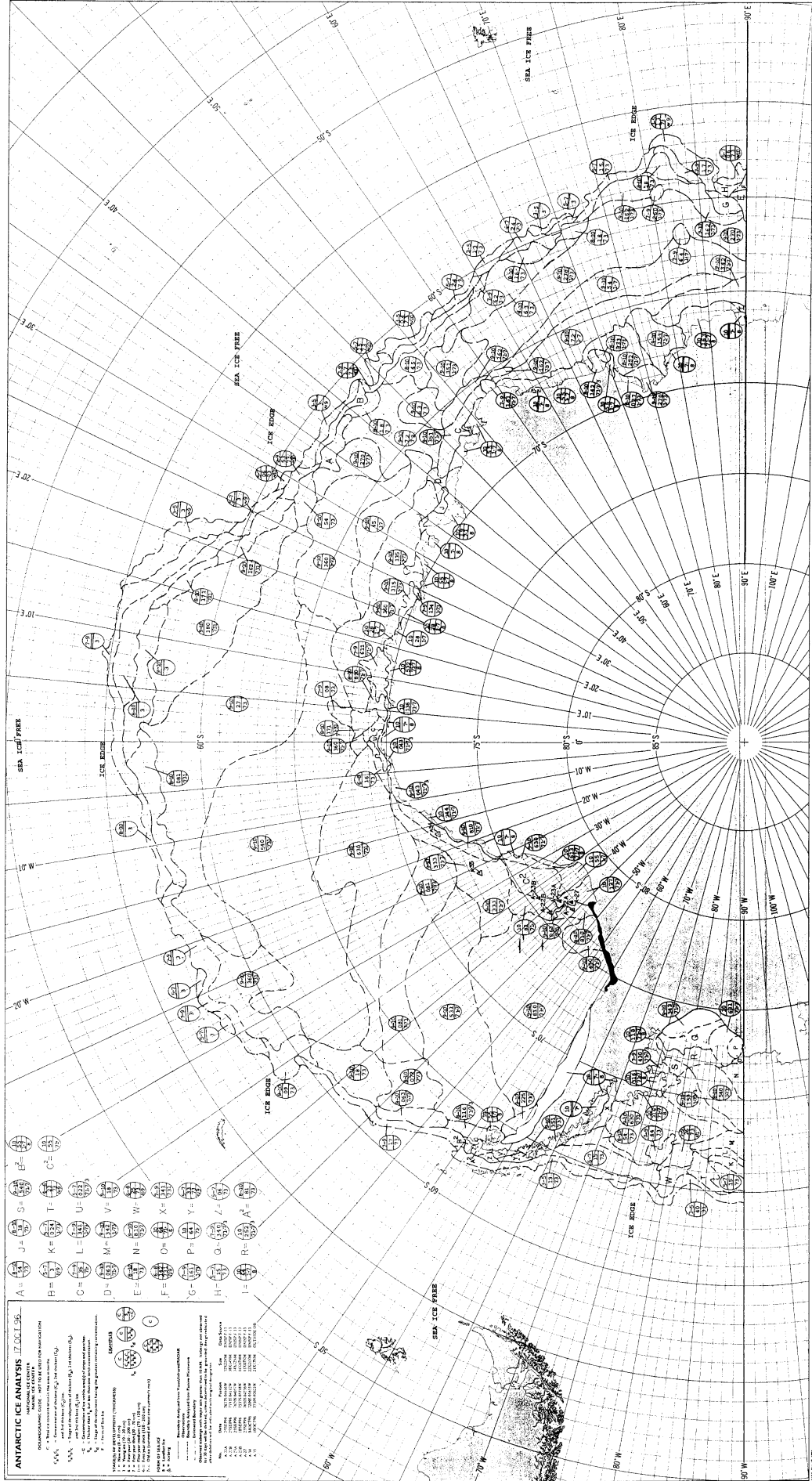




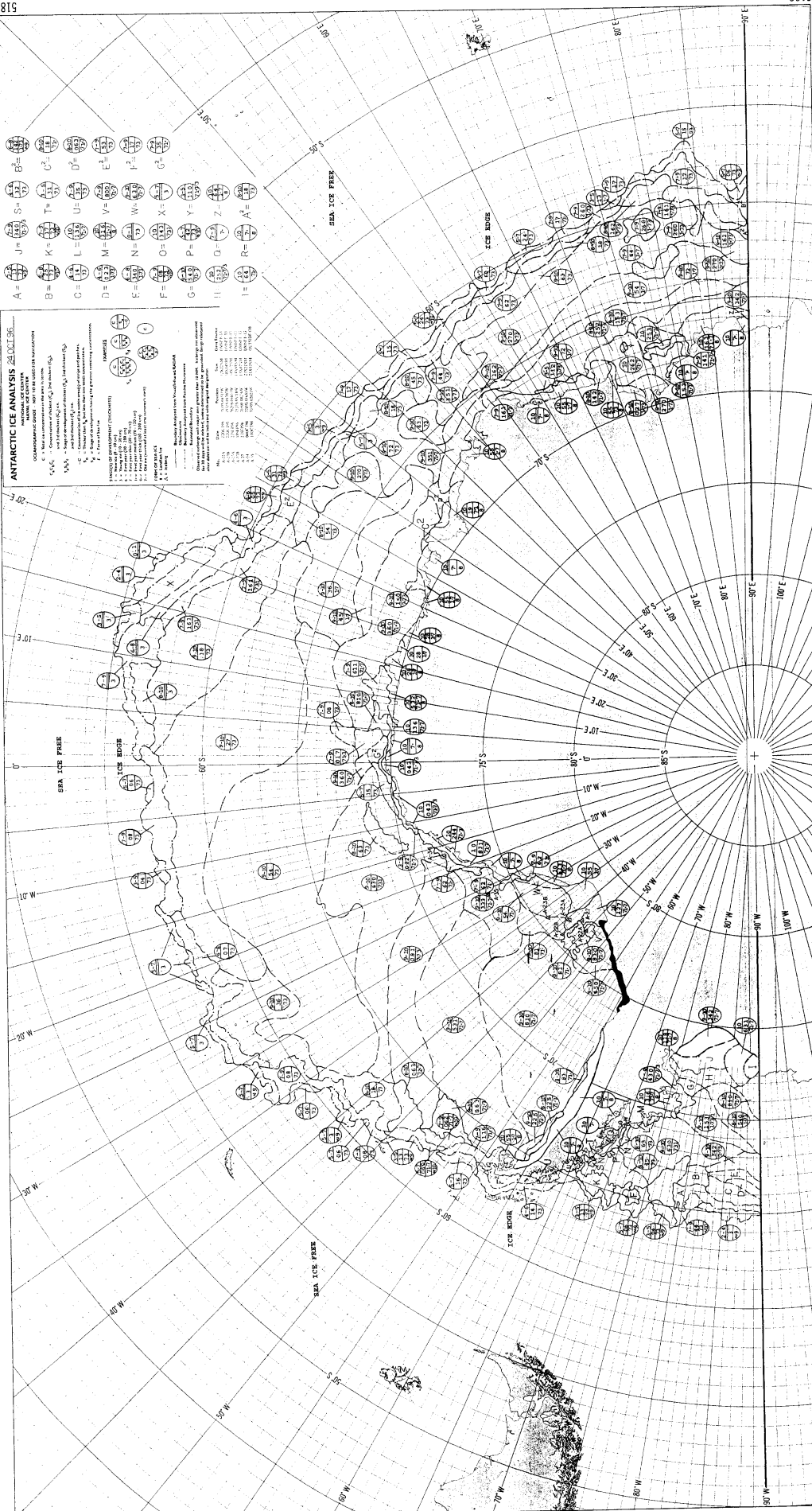




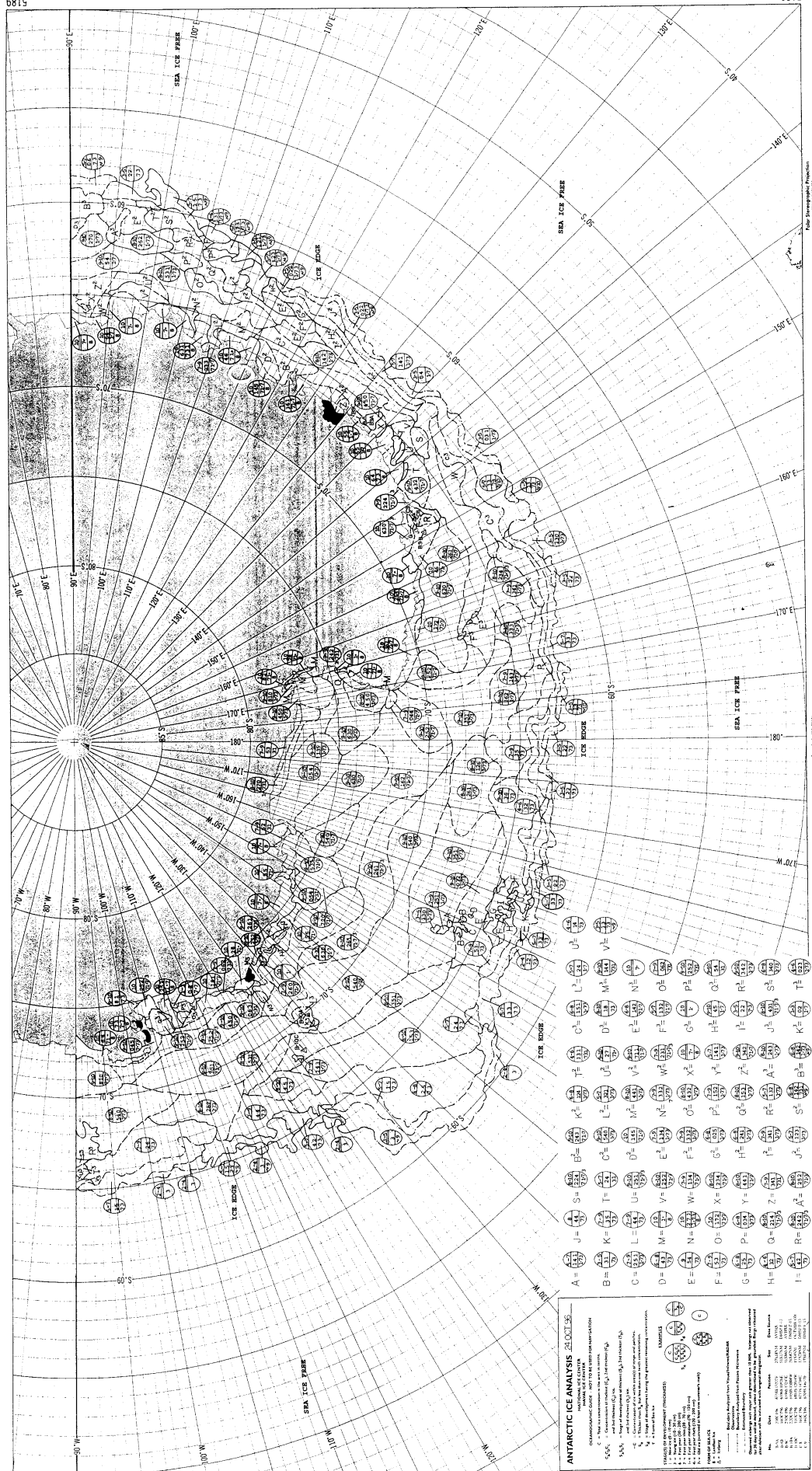








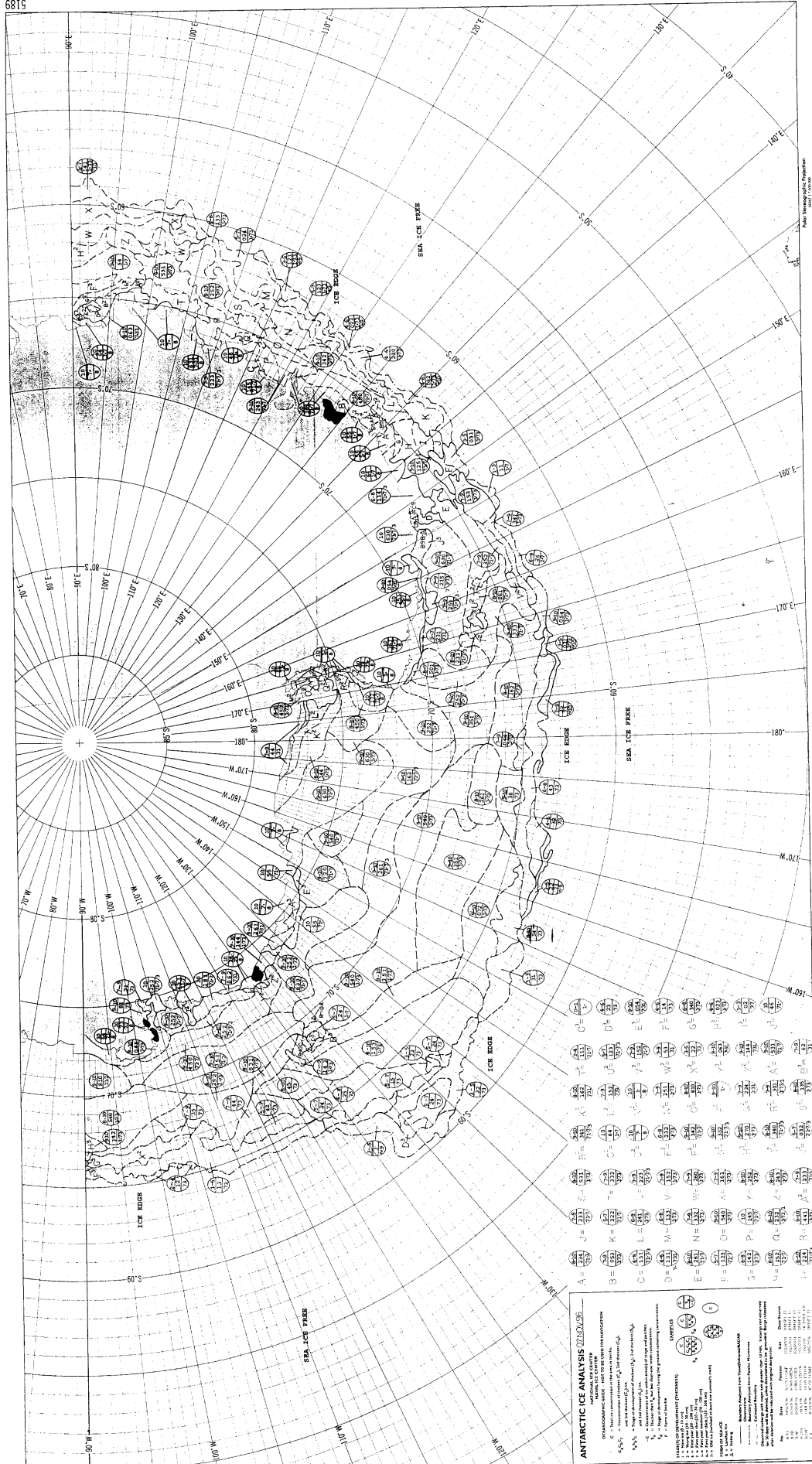












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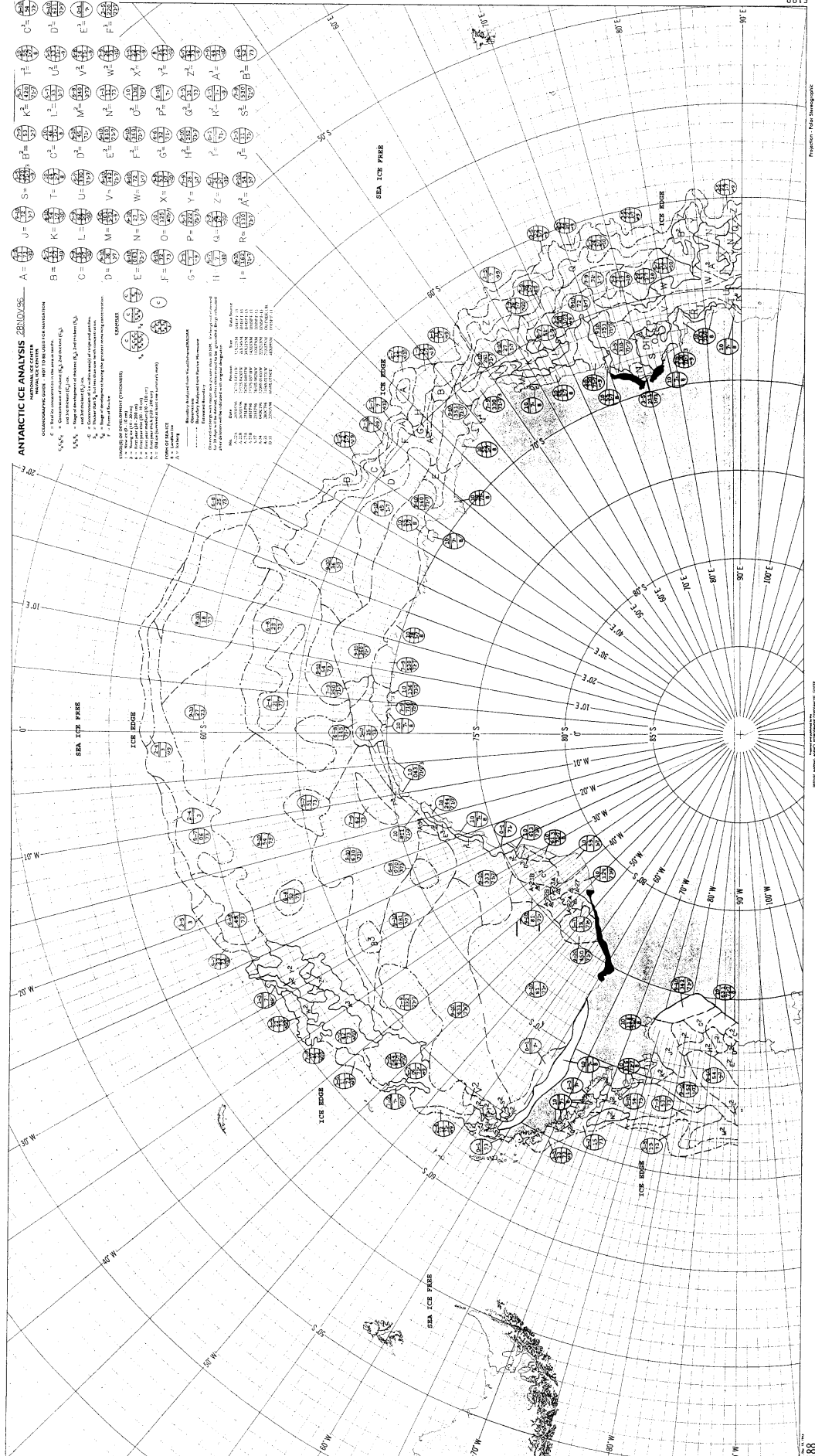


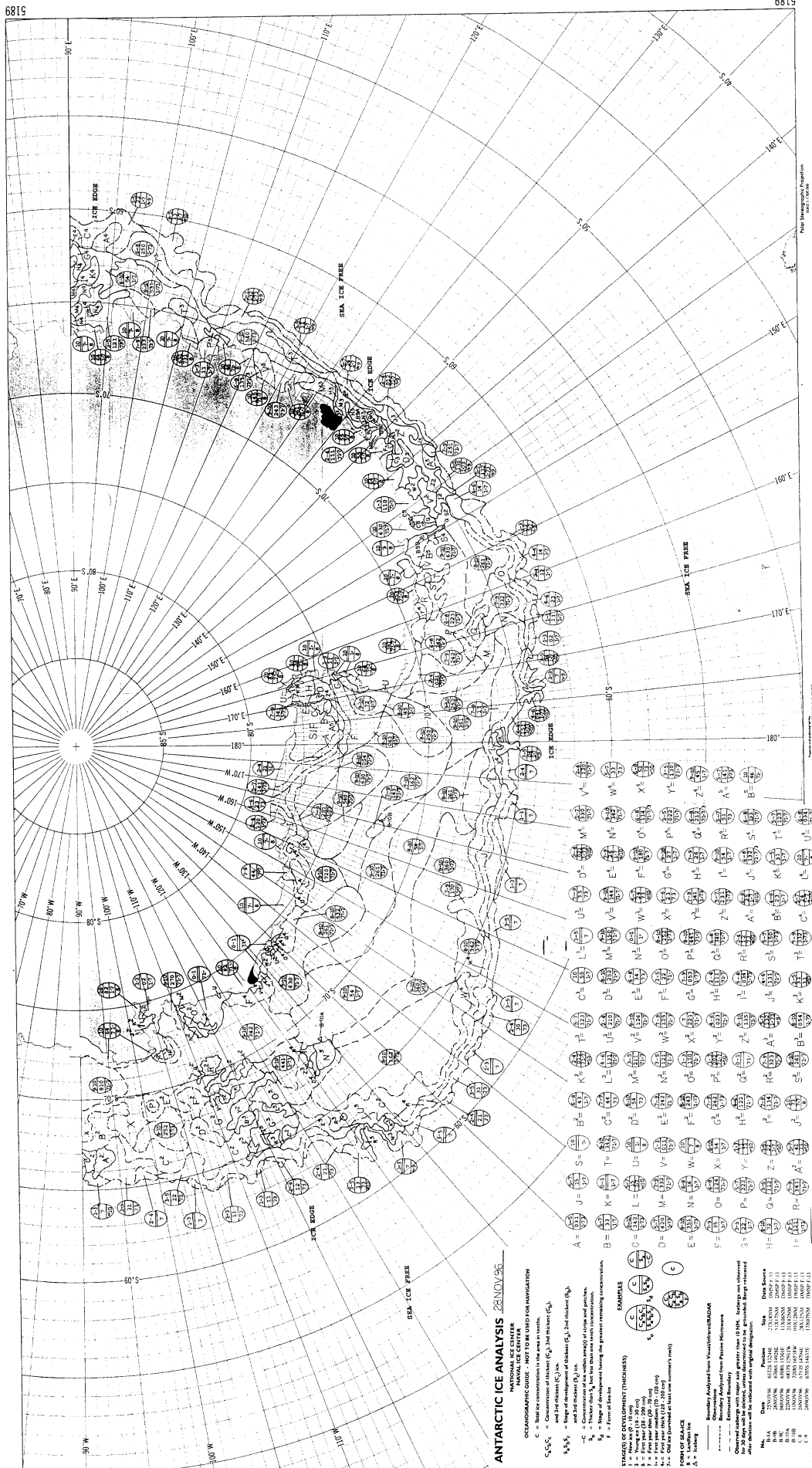












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NAVY ICE CENTER

ICE ANALYSIS GUIDE - NOT TO BE USED FOR NAVIGATION

C = Sea ice concentration in the area is 100%

C<sub>1</sub>C<sub>2</sub>C<sub>3</sub> = 1st, 2nd, and 3rd thickness (C<sub>1</sub>C<sub>2</sub>C<sub>3</sub>)

S<sub>1</sub>S<sub>2</sub>S<sub>3</sub> = Stage of development of distinct (S<sub>1</sub>S<sub>2</sub>S<sub>3</sub>) and distinct (S<sub>4</sub>)

and ice thickness (S<sub>4</sub>) ice

— = Thickness (S<sub>4</sub>) ice

— = Thickness (S<sub>4</sub>) ice, but has less than 100% concentration

S<sub>4</sub> = Stage of development having the greater remaining concentration

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